ELECTRICAL REVIEW

13th NOVEMBER, 1953

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VOL. 153: No. 20
Eighty-First Year
Fridays: Price 1/-

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

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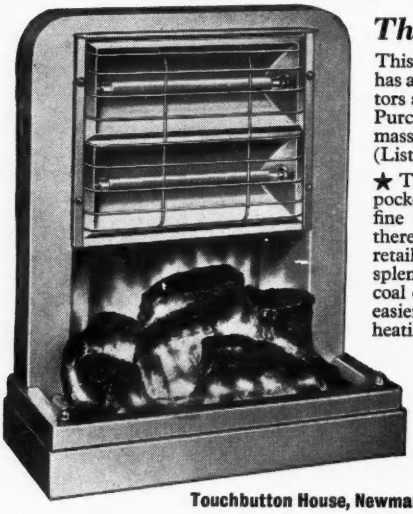

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ELECTRICAL REVIEW 13th NOVEMBER, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 20

Materials Handling

THERE is nothing new in principle in what has now become known as mechanical handling, which in its simplest terms means handling under power rather than manually. Well back into the last century such processes as coal raising up the mine shaft, coal conveying and lifting from the supply source and storage to the boiler bunkers in electric power stations, and the manipulation of hot ingots, billets and bars, etc., in steelworks were all firmly established materials handling processes simply because the quantities of materials to be dealt with were so large that manual handling was obviously impossible. During the greater part of the past century these methods have very gradually permeated the heavy industries, but until comparatively recently in the bulk of the factories throughout this country materials handling remained a manual operation. Within the last few decades, however, largely, we think, as the result of American influence on production in this country, we have seen the spread of mechanical handling into the smaller factory, sometimes with astonishing results by way of increases in production. In the *Electrical Review* of 25th May, 1951, we described how the same production was achieved in half the floor space in a Birmingham cycle factory as the result of installing a modern materials handling scheme.

All this supports the findings of the specialist team which was sent to the United States some three years ago by the Anglo-American Council on Productivity, namely, that improved methods of handling could make the biggest contribution to increased productivity in this country and that the lead gained by the United States was not the result of greater efficiency in the large factories but of greater efficiency in the average factory. Our particular interest in this means of increasing productivity is, of course, the electrical application, and so far as the medium and small factories in this country are concerned the complete absence of any other form of drive speaks for itself. True, in the collieries and the

steelworks we find here and there the comparatively large steam drive waiting for its capital depreciation to come to the point when the management can scrap it with a clear conscience. But it is largely because of the more modern developments in the control of electric driving that mechanical handling is becoming so essential a factor in any type of production. Beyond a wealth of extremely adaptable and reliable contactor equipment we have a newer and much more sensitive service from the electronics field, and in both of these spheres there are valuable contributions to sequence control which, probably more than anything else, leads to high efficiency in materials handling and low capital cost and maintenance.

ATOMIC POWER

The electrical industry, which is very much involved in the matter, is anxious to know what is to happen when the development of power from nuclear fission is handed over by the Ministry of Supply to a new statutory corporation. In the meantime Sir John Cockcroft, when he opened new physics laboratories at the University College of North Staffordshire last week, said that he was "fairly confident" that eventually nuclear power would supplant coal as the principal source of industrial power in this country. He did not prophesy how soon this would happen for it must be a gradual process extending over many years. The electrical industry will have to adapt itself to meet the special demands which the development of atomic power must create.

PARALLEL RUNNING

The chief technical problem in operating privately owned plant in parallel with a public supply system derives from a requirement of the 1882 Act that no consumer shall use current in such a way as to interfere with the supply to any other consumer. To prevent this happening and to secure safety of operatives and plant are the chief objects of a memorandum issued by the B.E.A., particulars of which are given on another page. This memorandum is not concerned with the more thorny question of the difference in value between a supply that is available as and when required by a consumer and reciprocal kWh from private plant that is dumped as surplus on the public network.

ENGINEERING WAGES CLAIM

At their fourth meeting with representatives of the Confederation of Shipbuilding and Engineering Unions the engineering employers again rejected the unions' claim for a 15 per cent wage increase. The Confederation's executive was to meet yesterday (Thursday) to formulate recommendations for future action. There have been many demonstrations of engineering employees at some of which strike action has been demanded. The less impetuous have called for a ban on piecework and overtime. Either course would have serious effects upon home and export production. In the end arbitration will almost certainly be resorted to and so both parties should make up their minds to choose arbitration now instead of waiting until much harm has been done.

MENTAL GYMNASTICS

We have yet to find the electrical engineer who does not rather delight in saying that a satisfying non-technical explanation of power factor is impossible. That may be so, at any rate where brevity is called for. But there is never any difficulty in finding new technical conceptions of power factor, and most of them provide refreshing mental exercise and generally fuller understanding. An instance of this appears in the article by Mr. A. G. Powell in this issue, although he may be taken to task for his statement that "no complete separation exists in practice between the resistance and reactance of a circuit."

Domestic Development

Promotional Sales: The Present Position

By E. A. FOWLER,
M.I.E.E., F.I.E.S.*

THE removal of the ban on advertising and other promotional selling efforts is a welcome relief to all who are concerned with commercial development in the electricity supply industry. Consumers, too, will appreciate the use of electricity as a "Power of good" rather than having to beware of the "peak." Of course, it is still necessary to exercise discretion in the publicity measures, particularly during the next few months. Nevertheless, the achievements in the years immediately following the war, and during the past five years, together with the present plant programme of the British Electricity Authority, clearly indicate the strenuous efforts made.

While the supply industry, manufacturers and others concerned have been overcoming the serious deficiency in plant availability, the engineering, planning and construction staffs of the Area Boards have also tackled their distribution problems in great earnest, and although much remains to be done there is now a more uniform and consistently sound practice of electrical distribution throughout the country than hitherto. In addition, excellent progress has been made with the arrears of system reinforcement.

It would seem, therefore, that the time has come for the industry once more to adopt a more progressive sales outlook and to encourage development, and the series of articles which has been appearing in this journal should prove a valuable stimulant to the sales staff of the Area Boards and others primarily responsible for the development of the electrical load. Previous contributors have adequately covered the many aspects of the problems involved and with regard to domestic electrification have established, or confirmed, three major principles:—

(*a*) That the electric cooker forms the key piece of equipment towards complete domestic electrification, with the water heater following as a close second.

(*b*) That such loads with high diversity are economic to supply and greatly assist system load factor improvement.

(*c*) That increasing capital expenditure in the electrical industry makes increased consumption with consequent additional revenue essential.

Reference to recent statistics shows that of approximately 12 million consumers connected in Great Britain to-day, some 2·5 million use electric cookers and it is obvious therefore that there is immediate scope in order to reach even 50 per cent "saturation."

It is, however, increasingly evident that the gas industry, who are the principal competitors, will strongly resist such electrical development and fierce sales competition can be expected to develop.

With the electrical plant position and distribution arrears largely overcome, and with a steady potential market ahead in existing and new consumers, it is obviously the right time to ensure that the industry is adequately equipped to shoulder its commercial responsibility. The range of apparatus that can be made available to consumers and the sales technique and methods required to secure successful results should be examined and extended. The present sales staffs have produced excellent results since the war, against serious difficulties, and we can be confident that they will continue their efforts with equal success.

There are, however, a number of problems which need careful consideration and

* Mr. Fowler is Chief Commercial Officer, Eastern Electricity Board, but the views he expresses are his own.

clarification if the sales staff are to gain confidence, and particularly this would seem so for new entrants to the sales field if they are to acquire the necessary background knowledge so vital in the competitive days ahead. Few sales staff under the age of 30 years have any real knowledge of the selling efforts required against fierce competition. Therefore, it would perhaps be useful to review in a critical, but constructive, light the present sales methods and equipment offered, with a view to building up the confidence of the sales staff while ensuring that the best possible use is being made, or can be made, of the opportunities now before the industry.

First, the prospective user of electric cooking and water heating will want to know how electricity running costs compare with gas, and it is essential that our sales staff should be given simple and reliable guidance in this important matter. The industry is in a strong position here since much sound information is available to show that electrical methods are more economical than gas in most parts of the country. A wealth of information on this subject is available in the excellent group of papers covering "The Merits of Electric Cooking, Water Heating and Comfort Heating" presented by a team of well-known and qualified authors at last year's British Electrical Power Convention; a much wider circulation of this series of papers to the electrical sales staff would prove invaluable. A salesman with a comprehensive knowledge of the basic information contained in these papers would be well equipped to answer many of the questions put to him.

Let us first consider the electric cooker. Are we satisfied with the present range, quality and performance of electric cookers? Generally speaking, we may say "Yes, in the present circumstances." We are, however, only on the fringe of what can be done by our leading manufacturers when they are assured of a steady and progressive market for their products, and feel that the supply industry means real business in going all out for the cooker load.

Without losing sight of the future possibilities of advanced design and fully- and semi-automatic control features, the industry can surely take pride in the good quality, appearance and efficiency of the available range of electric cookers which offers a selection to the consumer from "baby" table equipments to the two-, three- or even four-hotplate domestic cookers of all types and prices. Greater variety of models can be obtained to-day than was generally available before the war and they all compare very favourably with contemporary gas appliances and will surely meet the most fastidious needs of consumers.

Water Heater Position

A similar position is revealed in the case of water heaters. A wider range of types of immersion heaters is available than before the war and with a more extensive use of temperature control devices they can be adapted to almost any existing water heating system. Storage water heaters can also be obtained in a wide range to suit all needs. While reasonable sales results are being achieved at the present time with both storage and immersion heaters a sharp increase could be made if the pernicious

An effective showroom display in one of the Eastern Electricity Board's service centres

a newly-wed says...
ALL THE LATEST MODELS AVAILABLE
ELECTRIC COOKING IS DELIGHTFULLY SIMPLE
I FIND EVERYTHING TURNS OUT JUST LIKE THE RECIPE

purchase tax on this equipment were removed. The recent relaxation of the Hire Purchase and Credit Sales Agreement (Control) Order in respect of water heaters now permits them to be sold on a more extended hire-purchase period and this will go some way to relieve the position. But this would be more effective if accompanied by the complete removal of purchase tax from this equipment. Sales are restricted because the offering of long-period hire-purchase terms could prove embarrassing if the heavy tax should be removed shortly after a sale has been made, since it would be to the hirer's advantage to terminate the agreement and re-buy at the reduced prices.

Do the prices of these two major appliances line up with those offered for their gas counterparts? Speaking generally, and without undue complacency, I think that the sales staff can be confidently assured that serious competition can be met if cookers are offered on hire-purchase over seven years or longer.

There is, of course, an obvious need for a lower price range of cookers in order to meet competition in new towns and other similar large housing estates. However, increased demand right through the industry will, no doubt, help and encourage manufacturers to make further reductions in their prices which will be correspondingly reflected in the retail terms offered to consumers.

In some quarters enthusiasm is shown for a return on a large scale to simple hire for cookers and other appliances. But this would involve the Area Boards in a very considerable capital investment coinciding with the continued and urgent need for capital investment in system development. Secondly, if simple hire is to be self-supporting and there are proper maintenance provisions, it can offer very little advantage over long-period hire-purchase terms.

Increased maintenance provision for the later years and additional interest charges make extension of cooker terms beyond seven or at most ten years doubtful, since little cash advantage in the weekly terms can be shown to the consumer. Further, there are still a large number of obsolete cookers in use to-day, often let at uneconomic rates and while every effort is being made to reduce these, care must be taken not to increase the liability or to build up a problem for the future.

It is probably safe to say that a very similar problem, but of much greater magnitude, exists in the gas industry to-day. It is also interesting to note that the Eastern Electricity Board has disposed of between 20 and 30 thousand new cookers per annum during the past five years on cash or hire-purchase terms, against the fiercest of gas competition and during the "anti-electric" campaign period, which shows that good results can be achieved on

With the approach of Christmas a display of this kind is now appropriate

these lines. This means that during the five years about one in every ten domestic consumers has bought a new cooker from the Board and similar results have been achieved by many other Area Boards.

It is, perhaps, more necessary to-day than previously to ensure that the showroom shall be staffed by the very best quality, adequately trained and informed people. They will probably be responsible for meeting 90 per cent of the consumers and will be required to handle widely varying matters from applications for supply and tariff inquiries to questions covering any domestic appliance, its cost, terms and consumption of energy. Also, they will have to bear the brunt of complaints, trifling as well as genuine, over such things as disputed accounts, and bear with the ill-humour of some who are politically antagonistic towards nationalized industries. The paper work associated with the sale or hire-purchase of equipment must be fully understood and handled with ease by the staff.

If sales staff can be found who are keenly interested in their work, then they will co-operate fully in the maintenance of a well organized and efficient sales area and will endeavour to improve their knowledge in order to answer consumers' questions satisfactorily. There is continued room in this direction for sales supervisors to ensure that the staff are kept fully informed.

Outdoor Sales Representatives

One of the serious problems in the industry at the present time is the inadequacy of really well trained and experienced outdoor sales representatives. These form a vital link in the sales chain between the Service Centre and the consumer. Frequently casual inquiries are made at the Service Centre when in spite of the sales effort made by an assistant no result can be achieved at that time. Such "potentials" can readily be followed up by the sales representative in the field. Again, a sales effort initiated by the outside representative could likewise be carefully followed up by the showroom sales staff when the consumer calls in and complete liaison over such matters is really very desirable.

There is, unquestionably, considerable scope for new business with existing consumers as well as at the time of new connections and, if the work is carefully organized, the outside sales representatives can greatly improve the cooker and water heater "saturation" figures. It is essential, of course, that they should also be well informed upon tariff matters, accounts procedure, etc., since their advice and guidance in this direction can greatly assist consumer relationship in the field and so build up goodwill and confidence which in due course must increase their sales opportunities.

To ensure that sufficient sales staff will be available to meet the expanding needs of the industry, it is essential that a really effective and long-term sales training scheme shall be adopted. Many Area Boards have short-period training schemes in operation from time to time, whereby new entrants are given rudimentary training for a week or so, plus an introductory talk about essential items in the range of domestic appliances.

This kind of scheme achieved excellent results during the immediate post-war period and particularly while the "sellers' market" existed. With the return to competitive selling, coupled with the shortage of cash, every sale must now be won. It will call for the application of all the background knowledge and information which can be given by those with a wider selling experience to new entrants until they can stand on their own feet and create successful sales.

A suitable form of training may be on the following lines:—The new entrant should probably commence employment in the administrative section of the business on junior clerical work, accounts, stock and consumer records, etc., following at the same time a suitable part-time and evening study course. At the age of 18 years, if he is found to be suitable, has the necessary aptitude and is desirous of taking up sales work then training can be given for three to six months at a sales school operated under the guidance of a permanent instructor. This training, coupled with the background knowledge of activities, should enable competent sales staff to be trained and properly prepared for the serious work ahead of them. Permanent instructors could profitably provide refresher courses for existing sales staff to keep them fully informed of the latest developments.

There would also seem ample room for some improvement in the line of promotion

A window arrangement embodying an invitation to cooking demonstrations

of sales personnel. It is considered that youngsters engaged and trained in the manner suggested should be suitable material later for the more senior commercial posts and that a period of Service Centre work should be regarded as essential experience for ambitious men and women.

Arrangement of Displays

Modern electrical appliances have excellent qualities for display, being usually "streamlined" and up-to-date in appearance, finished in attractive colours and plated metal, all combining to produce a very strong sales appeal. Nevertheless, the widely varying sizes of such appliances call for very careful attention and selection if the layout of a display is to be balanced. Cookers and water heaters are often best shown with suitable background material bearing messages focusing attention on the salient points of construction, efficiency and performance, rather than surrounding them with a wide variety of smaller pieces, such as hair dryers, food mixers, lamps and so on. If the maximum sales result is to be achieved, it is important that the window and interior displays shall be properly co-ordinated with current local Press advertisements and outside sales effort.

Every opportunity should be taken of ensuring that the electric cooker and water heater are fully exhibited at local exhibitions and agricultural shows in which electricity usually plays an important part. For example, at some of the agricultural shows the emphasis naturally falls on electro-farming equipment, but the farmer's wife is more interested in the domestic benefits she may obtain from the electrical way of life and adequate displays of electric cookers and water heaters, in charge of properly informed sales staff, will produce good commercial results and improve the use of electricity in the rural areas.

The removal of restrictions permits bolder publicity to be developed and a full integration of the various media available. It is obviously essential that poster publicity should be carefully timed to take advantage of the sales appeal of various items at different times of the year, e.g., water heaters during the spring and summer. At the same time, such publicity must be backed up by suitable newspaper announcements, leaflets, brochures, etc., which adequately and clearly describe the appliance offered and give the price and terms on which it may be obtained. These leaflets and brochures should be freely available to consumers in the Service Centre and offered by the outside sales representatives.

Showroom Demonstrations

Most Service Centres possess a demonstration space and demonstrations can be supported by local Press announcements. Practical demonstrations should be given frequently for they provide admirable opportunities for bringing out the best points in electric cooking and water heating. However, it would seem that there is room for improvement: some of

the demonstrations have been known to develop into afternoon tea parties with very regular visitors taking advantage of the cup of tea, but with negligible results. Improvement can be effected by having other equipment available for demonstration, such as food mixers, refrigerators, laundry equipment, etc. Sales assistants should foster the interest of those attending the demonstration at the conclusion of the demonstrator's talk.

Practical demonstrations should not be restricted to those that are formally arranged and announced; demonstrators and, in fact, all sales assistants should be prepared at any time to give short working demonstrations of appliances, especially washing machines.

It is essential for the utilization qualities of electricity to be fully demonstrated at every opportunity to the various women's organizations, technical institutes, etc. Whilst it is not always possible to bring out sales features of a commercial character during such demonstrations, the emphasis should be on the economy, cleanliness and ease of cleaning, lack of smell, etc., which will probably arouse the listeners' interest and should ultimately produce results in the Service Centre.

All Employees are Concerned

There seems to be a growing tendency to regard the designated sales staff only as being responsible for sales development. It is, however, as necessary to-day as it ever was to ensure the continued enthusiasm for the "electrical way of life" of all staff associated with the electrical industry. To achieve maximum development it is just as essential for the typist, the clerk, the engineer, the power station superintendent, and all, to be convinced that electrical methods provide the most progressive and economical standards, and that at the present time there are efficient appliances available at competitive prices to meet all consumers' needs.

Electricians and meter readers and fixers can do a great deal as representatives of the industry when visiting consumers. It is therefore most important to ensure that the advice and guidance of the sales staff in discussions with consumers should also be fully appreciated by other members of the staff. Adequate background knowledge could enable them to encourage consumers to visit the Service Centres where detailed information about their requirements is readily available.

There is an obvious need in all these matters for full co-operation with the electrical contractors and it is clear that in most of the Boards' areas any early misgivings have been forgotten and the relationship is a harmonious one. This, of course, is a vital necessity, since the electrical contractor is just as much a factor in electrical development as the supply sales staff themselves. There is possibly scope for improvement in commercial co-operation and it is hoped that before long mutual advantage will be secured, particularly in the sales efforts in the cooking and water heating markets.

Reasons for Optimism

It is dangerous to be over-optimistic, but reference to the recent sales of electricity indicate that there has been an improvement in the consumption of electricity by domestic consumers. In the year 1947–48, 12,305 million kWh was sold to domestic consumers; the corresponding figure for 1952–53 was 16,260 million—an increase of 32 per cent. This increase is not, of course, only due to the development of the electric cooker and water heater markets, although progress in that direction has been reasonably steady during a very restricted period. But there is considerable scope for development of these two major appliances and if the industry as a whole is prepared to build up and maintain an adequate and well trained sales staff whose place in the industry is recognized as being of equal importance to those in the engineering and other branches, there would seem very sound reasons for optimism.

In particular it is encouraging to note the acceleration in sales of almost all domestic appliances over the past six months. There is every reason to suppose that this acceleration can be maintained and improved if full advantage is taken of our newly found freedom to return to promotional activities.

The observations set out in this contribution must be regarded as personal, but at the same time I would like to record my appreciation to my colleagues for their co-operation. Grateful acknowledgments are also tendered to the chairman of the Eastern Electricity Board for his permission to publish this article.

Engineering in Europe

Survey of Current Literature

THE numerous and obvious advantages of the usual electromagnetic d.c. drives of circuit breakers, particularly their instantaneous and continuous availability and independence of the system served by the circuit breakers, are offset by at least the same number of drawbacks, among which the necessity of heavy and expensive accumulators operating under unfavourable conditions is conspicuous. The idea of using the operating a.c. of the system for circuit breaker drives has therefore much to recommend it, particularly since there is only one further step to fully-automatic operation.

The versatility of a.c. would seem to complicate the issue since there are so many different solutions, direct as well as indirect. The direct way is represented by electromagnetic a.c. drives; the indirect way by operation by rectified a.c. which may, or may not, use the conventional d.c. drives and dispense with the battery. There remains the problem of the most satisfactory type of rectifier to be used if this method is chosen. These problems are thoroughly and comprehensively analysed.—" Control of H.V. Circuit Breakers by the Operating Alternating Current," L. K. Greiner and N. N. Nikiforovskii, *Elektrichestvo*, No. 5, pp. 50–56, 1953, in Russian.

Dielectric Breakdown

Advances in the theories of thermal and electric breakdown show that for various design purposes admittedly over-simplifying representations of the very complex physical facts still yield useful approximations. It is essentially the problem of the possibility of obtaining a state of equilibrium between heat production by the power losses and heat rejection by conduction and, to a smaller extent, by radiation. Another temperature-breakdown relation applies for thick insulations at high temperatures and for thin insulations at low temperatures. In the latter case there is a certain limiting value of the field strength bearable by the material. If this is exceeded mechanical destruction of the material occurs (intrinsic electric strength).

This phenomenon was represented by Rogowski's theory, later on considerably extended and put on foundations in accordance with modern theories of the thermal movement of the lattice elements of crystal structure and of the quantum theory of the excited states. The latter progress is mainly connected with Hippel's school at the Massachusetts Institute of Technology and with Dr. S. Whitehead's and Prof. Frohlich's school at the E.R.A. Experimental methods of great interest were also developed by the E.R.A., mainly on the optical detection of discharges and ionization in the insulation, whereas Standard Telephones and Cables, Ltd., succeeded in evolving a method for making the ionization noise in certain transparent insulation materials (polythene) visible.—" Recent Additions to our Knowledge of the Dielectric Breakdown," K. Konstantinowsky, *E.u.M.*, Vol. 70, No. 10, pp. 224–230, 15th May, 1953, in German.

Interference from H.V. Lines

The disturbing field of a corona streamer has two components, the first of which is the direct field radiated in the air which is ionized by small leakage currents, and the second field guided by line and emitted by the components along the line of the streamer currents. The latter field is negligible because it decays rapidly. The effects of impulse waves (set up by streamers) on three phases are not superposed or summed up, but come nearer to the single-phase effect of the phase with the highest potential gradient.

These few general facts helped a great deal in the evaluation of numerous frequency spectra recorded along French h.v. transmission lines the character of which is very variable, partly for reasons connected in an understandable way with line configuration and operating conditions, partly in a way difficult to interpret. Of great value for the main subject of the investigations are the damping diagrams of the

impulse waves along a line and in planes normal to the direction of the line, especially if this plane passes through supports, the insulators of which always represent powerful sources of interference.

One of the most important results obtained is that the character of the interference effects of 400 kV lines is identical with that of the effects of 220 kV lines, although certain features are in the case of the higher voltages accentuated by reflections of the waves at the line ends. Obviously the interference range is larger in the last case. Television reception is comparatively unaffected by h.v. and v.h.v. lines.—" Interference Effects on H.V. Lines of Broadcasting and T.V. Transmission," P. Passerieux, *Bull. Soc. Franc. Elect.*, 7th series, Vol. 3, No. 31, pp. 432–444, July, 1953, in French.

Overhead Line Earth Resistance

The measurement of the earth resistance of single overhead line towers is possible by conventional methods if either the connection between tower and earth electrodes is accessible, or if the earth wires may be disconnected (in the latter case, if the connection between earth electrode and tower is inaccessible, only the combined earth resistance of concrete foundation and earth electrode may be determined). Disconnection of earth wires is usually impossible while the line is in operation, and may be impracticable even on an isolated line section. Methods of measurement not requiring disconnection of earth wires have been suggested, but are all either too inaccurate or too laborious.

The authors have evolved a method free from these drawbacks. It works with a voltage wave applied between tower and earth which travels towards the other towers through the earth wires and directly to earth. This wave is reflected at the two neighbouring towers owing to the discontinuity of the impedance represented by the earthing of the latter towers. The time intervals between direct and reflected waves are measurable and of the order of 1 μsec. If during this interval the resistance offered to the impulse may be measured it is easy to find the earth resistance of the tower considered.

In a first approximation the impedance offered to the voltage pulse may be regarded as a parallel arrangement between tower earth resistance and surge impedances of the two earth wires. The method works with pulse trains at 0·02 sec intervals and oscillographic detection and solves the problem satisfactorily.—" Measurements of the Earth Resistance on Overhead Lines with Earth Wires," R. Marenest, A. Paolucci and A. Galeazzi, *Energia Elettrica* Vol. 30, No. 4, pp. 236–240, April, 1953 in Italian.

Synchronous Generators

The author had previously given a theory of the self-excitation of a synchronous machine with a capacitative load, this process being the generation of undamped natural oscillations of the system in the absence of any external e.m.f.s as the effect of periodical variations of the system parameters. The treatment was based on the ideal (i.e., hysteresis-free) magnetization curve of the machine on whose linear initial section the initial disturbance may theoretically be assumed as infinitesimal. In reality, the building up of oscillations requires a residual no-load voltage of a few volts as the initial disturbance.

The investigation is now extended to the actual oscillation processes in the circuits of the machine and the particular behaviour of the resultant electromagnetic field set up by the flux linkages between the circuits, voltages and currents interacting. The periodical amplitude variations of current and voltage, slip between stator and rotor fields and the cyclic variations of active and reactive power in conditions of " steady " asynchronous self-excitation are investigated by the author in greater detail.

The settling process is considered for a saturated machine, by means of a method using a " stepped " magnetization curve. The zones of instability are delineated by the limiting curves of synchronous and asynchronous self-excitation, respectively. The shift of the latter during the settling process is followed up. The approximate theory given may be improved by a representation using Weierstrass functions. —" The Settling Processes in Asynchronous Self-Excitation of Synchronous Generators," R. M. Kantor, *Elektrichestvo*, No. 7, pp. 17–22, 1953, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Steels for Permanent Magnets

Survey of the Main Types

By J. C. WILLIAMSON, B.A.*

THE steels from which permanent magnets are made can be divided into two main categories, known technically as quench-hardening and precipitation-hardening alloys. The former group includes chromium and tungsten steels as well as a series of cobalt steels with from 2 to 36 per cent of that element as an essential ingredient. These are true steels, containing 0·7 to 1·1 per cent of carbon, and must be hardened by water-quenching, oil-quenching, or rapid air-cooling from a high temperature in order to develop their magnetic properties. The second group consists of alloys which some metallurgists might hesitate to call steels, containing carbon only in small quantities as a deleterious impurity, and characterized by the presence of nickel and aluminium, usually with cobalt and copper and often other minor constituents. The latter alloys are heat-treated by cooling at a carefully controlled rate from a high temperature in order to produce a single-phase structure, followed by the precipitation of a second phase at a temperature in the 500 deg to 700 deg C range for a time which may be as short as one hour or as long as 100 hours, according to the material. By force of habit, the first of these operations is generally known as " hardening " and the second as " tempering," from the effect which similar treatments would have on the earlier magnet steels, but in fact the material remains mechanically very hard throughout, while the so-called " hardening " usually makes it magnetically comparatively soft and the so-called " tempering " develops magnetic coercivity and is analogous to hardening.

Continual development in the power of magnetic materials has made possible a gradual extension of their fields of application. This development has been so rapid since about 1930 that many misconceptions are caused by the persistence of ideas applicable to the earlier materials but no longer appropriate for the more powerful modern alloys. Some of these the author attempts to remove in this article

Materials which are not steels are used for permanent magnets, for example, certain oxides, a few alloys with manganese or cobalt as a base, and the ceramic ferrites, but these, though interesting and very useful for special applications, are used in comparatively small quantities and will not be dealt with here.

Let us consider first the quench-hardening magnet steels. These can all be manipulated in the same way as other steels, by forging, rolling and bending when hot and by the stamping of flat shapes from strip when cold; when suitably annealed they can be shaped by turning, milling, drilling and tapping as well as grinding. Most of them (but not tungsten steel) can also be cast in sand moulds to produce individual magnets. The following paragraphs describe a typical sequence of operations in what is hoped will be just sufficient detail to convey an idea of the limitations of these materials.

Melting is generally in a high-frequency induction furnace, of capacity rarely exceeding 10 cwt because of the high degree of purity required and the close control over the composition and condition of the steel which is necessary. The molten steel is poured into ingots of a size and shape depending on the section of the finished magnet. For the production of a sound ingot even more care is required than for most steels, largely because of the difficulty in deoxidizing thoroughly without exceeding the small amount of silicon (about 0·3 per cent) which can be tolerated in these steels. A greater silicon content would lead to a low value for the remanence of the material.

*Magnet Department, Darwins, Ltd., Sheffield.

Forging and rolling are now carried out in the usual way to produce bars or flat strips of the material. The strips are annealed, generally by slow cooling from about 900 deg C, and the required shapes are punched out by dies; it has been noted that cobalt steels are sometimes susceptible to a kind of "temper-brittleness" and must not be cooled too slowly from about 600 deg C. The bars are cut into suitable lengths and bent in presses at 900–950 deg C to produce the well-known U-shapes and the various profiles of meter magnets (Fig. 1), care being taken not to hold the magnets in this harmful temperature range for longer than is necessary. If these magnets are now to be machined, say, by drilling, they must first be annealed; after hardening it will be possible to shape them only by grinding.

The hardening treatment for the cobalt steels is not usually a simple quenching, though the latter is sufficient for the tungsten and chromium steels. It is a triple treatment: first an air-cooling from 1,100–1,200 deg C, which produces a large proportion of austenite, then a short time at 700–800 deg C to break up the austenite with formation of uniformly fine carbide particles, finally an air-cooling or oil-quench from about 1,000 deg C which imparts the required structure of martensite with some retained austenite. Castings may join the other magnets with the second of the above treatments, the casting process having taken the place of the first.

The nickel-aluminium alloys follow a somewhat different programme of operations. Melting is preferably carried out in even smaller furnaces because of the very close control over composition which is required; in some of the alloys the permissible range of aluminium content is only 0·5 per cent and aluminium is difficult to control because of its great tendency to oxidize at high temperatures. A basic lining is generally preferred, for silicon is usually very harmful and very pure materials must be used, since even small quantities of many elements can cause a noticeable reduction of magnetic properties.

The magnets are generally made as individual castings (Fig. 2), though thin bars are occasionally cut into short lengths, and the "chocolate-bar" technique of a grooved slab subsequently broken up has been used, taking advantage of the extreme

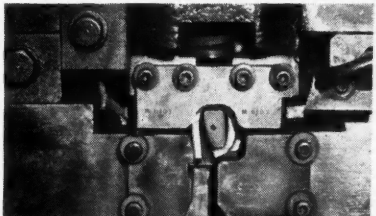


Fig. 1—Bending magnets of chrome-cobalt steel on a press designed and built by Darwins, Ltd., showing (in foreground) types of electricity meter magnets made by bending bar material

brittleness of these materials. Holes, where required, are usually produced by sand cores in casting, though it is possible by a rather lengthy process to anneal the alloys sufficiently to allow drilling. Apart from this, the only machining possible is grinding, which imposes some limits on the shapes which can be produced.

Grinding follows heat-treatment, the principle of which has already been described. The oldest of the new alloys, "Alni" and "Alnico," are isotropic, meaning that their properties are the same in all directions. They are heated to a high temperature, about 1,200 deg C, and cooled at a controlled rate, varying with the alloy and with the final properties required. During the later part of the cooling some precipitation occurs, but it is usual to re-heat to about 600 deg C for an hour or two in order to complete the process. The newer alloys, typified by the "Alcomax" range of materials, are given a greatly enhanced magnetic strength in one direction by the application of a magnetic field during cooling. The magnetic properties at right angles to the preferred direction are very poor, but, since a magnet can be magnetized in one direction only at a time, this is no detriment. It will be appreciated that it is of the utmost importance that magnet users ordering "Alcomax," or other anisotropic materials, should indicate clearly in which

direction they will require the final magnetization, since this must be taken into account at an early stage in the manufacture. The precipitation-hardening of "Alcomax" and similar alloys is usually a slow process, involving up to 100 hr at temperatures in the range of 500 to 700 deg C, and taking place in at least two stages. The magnets may be cooled at a controlled rate through the required temperature range or may be held first at a higher then at a lower fixed temperature for a determined period.

Because of the requirement of a magnetic field during cooling, anisotropic magnets are preferably in the form of simple blocks or cylinders magnetized along a straight line; slightly curved shapes are not difficult, but C-shaped magnets with a small gap must be treated on a conductor carrying a very large electric current in order to produce a circular magnetic field, which imposes certain limitations on this type of magnet. Fortunately the extra cost of the special heat-treatment is compensated for by a remarkable improvement in magnetic properties, the energy value of "Alnico" being multiplied by at least $2\frac{1}{2}$ for "Alcomax II" and by about 3 in the case of "Alcomax III."

It will be obvious from the above description that the manufacturing costs of permanent magnets are inevitably high. The materials used are also expensive; the "Alcomax" alloys contain about 24 per cent of cobalt, "Alnico" about 12 per cent, while "Alni" contains over 25 per cent of nickel, and most of the ingredients have an increased cost on account of the high degree of purity which is called for. Permanent magnets are therefore relatively costly articles and their wide use indicates that they have exceptionally valuable properties. The most general of the latter is their independence of a supply of external electricity, which enables them to be used in any situation and in devices where the introduction of leads would be difficult; this feature may also be an economy in such applications as the separation of unwanted iron and steel particles from liquids or powders, where the power consumed by equivalent electromagnets can be appreciable.

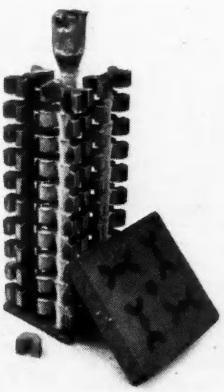


Fig. 2—Cast "Alnico" magnets; individual castings, one of which is shown, are easily broken from the runner

Another important property, of which perhaps not enough use is made, is stability. The field of a properly aged permanent magnet is quite constant, being free from the sometimes annoying effects of mains voltage or frequency fluctuations, so for applications requiring extreme constancy even a large magnet may be much cheaper than complicated electronic stabilizing apparatus. There is a small temperature coefficient, about $-0{\cdot}02$ per cent per deg C for most nickel-aluminium alloys, but this can be compensated for by a magnetic shunt made of an alloy whose permeability decreases rapidly with rising temperature.

Many people do not realize the immense increase in the stability—one might say, in the "permanency"—of permanent magnets which has resulted from the new type of metallurgical structure, or the increased coercivity of the new alloys. The cobalt and earlier steels are in an unstable condition after quenching, so that the magnetic strength decreases slowly at ordinary temperatures and much more rapidly as the temperature is raised, and is not completely recovered except by re-treatment. In the nickel-aluminium alloys, however, no measurable change of the structure takes place at normal temperatures and the slight loss on heating is reversed on cooling if the temperature does not exceed about 500 deg C, since the prolonged heat-treatment in this temperature range ensures stability at lower temperatures. The newer alloys are also more stable against the effect of magnetic fields, as will be clear from the later

discussion of their demagnetization curves. In practice, the demagnetizing effect which is most to be feared is that of other equally strong magnets. Such a simple action as sliding apart two "Alcomax" bar magnets which have stuck together, once only, may reduce their strength by as much as 20 per cent. Magnets should be allowed to come into contact only at their poles, N to S and S to N, and a useful simple rule for separating them is to do it in the most difficult way possible, namely, by a direct pull without sliding. The same advice applies to the removal of mild steel keepers, though here the effect of sliding is not so great.

The properties of permanent magnet materials which determine the performance of a magnet are summarized by the demagnetization curves, Fig. 3; the values shown are average results and should not be specified as minimum values; on the other hand, appreciably higher values are often obtained when the size and shape of the magnet are suitable. The approximate compositions of the alloys illustrated are given in the table.

The relative importance of remanence (the B value when H = 0) and coercivity (the H value when B = 0) can be explained by an electrical analogy. We can think of the air-gap, the space occupied by the useful magnetic field, as a resistance through which a current, the magnetic flux, is driven by a voltage, the magneto-motive force. The resistance, which is here called reluctance, is proportional to the length of the gap and inversely proportional to its cross-section, just like the electrical resistance of a conductor; the flux is the product of the induction, B, and the cross-section of the magnet; the m.m.f. is the product of the field-strength H and the length of the magnet. Thus a long gap of relatively small section, such as that of a

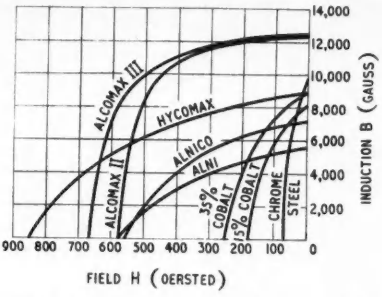


Fig. 3—Demagnetization curves of some magnet alloys

radar magnet, requires a long, rather narrow magnet, or a magnet of high coercivity which can work at a high value of H; a short gap of large section, such as is common in loudspeaker magnets, requires a magnet of comparatively large cross-section or of high remanence, capable of maintaining a high B value.

Any given magnet works at a definite point, or, more exactly, over a given range of points on the demagnetization curve when it is freshly magnetized. The effect of a disturbing magnetic field is to move the working-point to the left, and it will be seen that the corresponding drop in the magnetic flux is generally much greater for the older steels than for the newer alloys, and that fields which would completely demagnetize the former can be withstood by the latter. If such a field is removed, the magnet will not regain its former strength, but the working point will move on a line of less slope to a point below the starting point. Thus to confer stability against external fields magnets should be "aged," usually by being subjected to the field produced by alternating current. The amount of ageing

COMPOSITION AND PRINCIPAL MAGNETIC PROPERTIES OF STEELS

Material	Approximate Composition, per cent					Average Magnetic Properties		
	C	Co	Cr	Mo	W	B rem.	(BH) max.	Hc.
Chrome steel ..	0·9	—	3	—	—	9,800	285,000	70
15% Cobalt steel ..	1·0	15	9	1·5	—	8,200	620,000	180
35% Cobalt steel ..	0·9	35	5	—	4	9,000	950,000	250
	Ni	Co	Al	Cu	Nb			
"Alni"	25	—	12	—	—	5,600	1·25 × 10^6	580
"Alnico"	16	12	9	5	—	7,250	1·7 ,,	560
"Hycomax" ..	21	20	9·5	2	—	9,000	3·2 ,,	850
"Alcomax II" ..	11	24	8	5	—	12,400	4·5 ,,	575
"Alcomax III" ..	13	24	8	3	1	12,500	5·0 ,,	670

depends on the type of alloy and on the degree of stability required; for cobalt steels a reduction of 7 to 10 per cent in the flux is usual, while for the nickel-aluminium alloys 3 to 5 per cent is generally sufficient. It should be noted that this so-called "artificial ageing" decreases the sensitivity of the materials to temperature and to reduction of strength by impact or vibration.

It is impossible briefly to enter into the many interesting topics concerning permanent magnets, such as the explanation of the great strength of the anisotropic alloys, or the design of magnets and choice of alloys for various applications. The interested reader is referred to such books as "The Ferromagnetic Properties of Metals and Alloys," by K. Hoselitz, for the theoretical background, and "Permanent Magnets," by F. C. Spreadbury, for an account of the practical applications.

The author is indebted to the directors of Messrs. Darwins, Ltd., for permission to publish this article and to the Publicity Department of that company for the photographs reproduced.

E.R.A. REPORTS

TWO of the reports which have recently been issued by the British Electrical and Allied Industries Research Association deal with flameproof electrical apparatus. One of these, Report Ref. G/T280 by T. J. A. Brown and N. Simpson (7s 6d), is entitled "Flameproof Electrical Apparatus: Flanged Joints, One Inch in Radial Breadth, in Mixtures of Ethyl Ether Vapour and Air."

For explosive mixtures of ethyl ether vapour and air, ignited in a bronze sphere having horizontal equatorial flanges of 1in in radial breadth, the most incendive internal mixture is that containing 4·0 per cent of ether vapour by volume; the most readily ignitable external mixture contains 3·0 per cent of ether vapour by volume. For this combination of internal and external mixtures, the maximum experimental safe gap (m.e.s.g.) on a criterion of n=20, k=0·001in is 0·033in, and the statistical maximum safe gap (re-assessed) (s.m.s.g. (r.)) is 0·024(7)in.

The experimental and statistical safe gaps obtained with flanges of 0·5in radial breadth are set out in Ref. G/T277. A comparison of the results given in that report with those now presented shows that as a result of the reduction in flange breadth from 1in to 0·5in, the m.e.s.g. is reduced from 0·033in to 0·029in, i.e., by 12 per cent; and the s.m.s.g. (r) from 0·024(7)in to 0·020in, i.e., by 20 per cent.

The second report is Report Ref. G/T284, "Flameproof Electrical Apparatus: Flanged Joints, One Inch, and One Half-Inch in Radial Breadth, in Mixtures of the Vapour of Methyl Ethyl Ketone and Air," by T. J. A. Brown and N. Simpson (10s 6d). For explosive mixtures of the vapour of methyl ethyl ketone (m.e.k.) and air, ignited in a bronze sphere having horizontal equatorial flanges of 1in radial breadth, the most incendive internal mixture is that containing 4·5 per cent of m.e.k. vapour by volume. The most readily ignitable external mixture contains 3·7 per cent of m.e.k. vapour by volume.

With this combination of internal and external mixtures, the m.e.s.g., on a criterion of n=20, k=0·001in, is 0·033in, and the s.m.s.g. (r), is 0·027in. When the flange breadth is reduced to 0·5in, the most incendive internal mixture contains 4·6 per cent of m.e.k. vapour by volume, and the most readily ignitable 2·9 per cent. The m.e.s.g. is then 0·030in and the s.m.s.g. (r) 0·023in.

The effect of reducing the flange breadth from 1in to 0·5in is to reduce the m.e.s.g. from 0·033in to 0·030in, i.e. by 9 per cent: the s.m.s.g. (r) is reduced from 0·027in to 0·023in, i.e. by 15 per cent.

Modern Dielectrics

Report Ref. L/T275 by J. V. L. Parry (N.P.L.) (6s) describes an investigation of the electrical properties of polytetrafluorethylene (C_2F_4, known as p.t.f.e.) and polychlortrifluorethylene (C_2ClF_3, known as Kel F) over a wide range of frequency and temperature. The properties of the former are typical of a nonpolar material, whereas the latter exhibits dipolar properties, which is to be expected from the

introduction of the chlorine atom into the structural unit.

As is usual in dipolar solids, the low frequency absorption band in Kel F is broader than the simple Debye curve. The broad absorption is thought to be due to the influence of dipolar interaction in producing a variation in the heights of the potential barriers between equilibrium positions of the dipole. It is estimated from the results that this variation is of the order of 18 per cent. A feature of the results is the rapid increase of the maximum value of the power factor, with respect to change of frequency, as the temperature is increased. This is shown to be associated with a small increase in the value of the static permittivity with increase of temperature. The variation of the spread of relaxation times, and of the maximum value of power factor, with temperature, is shown to be in excellent agreement with the extension of Debye's relations derived by Fröhlich.

In report Ref. L/T249 it was shown that for pure ketones the dielectric constant changes discontinuously at the melting point, from a low value, characteristic of the solid, to a high one, characteristic for the liquid. The gradual transition from solid to liquid, which was found by Muller, is due to impurities.

The great effect of small amounts of impurities on the dielectric properties of ketones raises the question why these materials are so sensitive to contamination. Report Ref. L/T281, "Effects of Contamination on Structure and Properties, with Special Reference to Long-Chain Ketones," by V. Daniel, Ph.D., F.Inst.P., and C. Turner, Ph.D. (6s), shows that impurities have no appreciable effect on the solid structure of the materials in question. However, the impurity effects can be understood in terms of the physical chemistry of mixtures. Ketones, as solvents of impurities, are an example of a type of behaviour which leads to large effects of contamination on dielectric properties.

The application of the method of test, described in Ref. L/T237, to a small range of insulating materials under conditions designed to allow statistical evaluation of the effect of several variables, has enabled recommendations to be made for improvements in the method of test. These are described and a comparison is made with similar work being done elsewhere in Report Ref. A/T136, "Tracking in Solid Insulating Materials: Variables in the Test for Susceptibility to Tracking," by V. E. Yarsley, W. J. Grant and G. C. Ives (24s).

Report Ref. N/T63, "Bitter Figures and Single Crystals of Nickel and Nickel-Iron," by Prof. L. F. Bates, F.R.S., and G. W. Wilson (24s), is a record of work carried out to throw further light on the theoretical aspects of the domain concept and on the nature of the fundamental and subsidiary domain structures of the ferro-magnetic metals and their alloys. Copies of all the above publications are available, at the prices indicated, on application to the E.R.A. at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Power Station Trends in America

NEARLY 27,000 MW (name-plate rating) of generating plant is expected to start operation in public supply stations during 1953–54–55 in the United States. A survey by *Power*, tabulating the leading features of new and projected power stations, shows that a majority of turbines have steam conditions above 1,400 lb/sq in and 1,000 deg F, accompanied by steam reheating.

New records are being created with turbo-generators of 250 MW and boilers of 1,650 klb/hr, 4,500 lb/sq in and 1,150 deg F, two stages of reheating and up to eight bleed points, but most with five. Reheat turbines, which form about half of the total number of units, will provide 71 per cent of the MW capacity; their average rating is 130 MW against an average for conventional regenerative units of 49 MW. Of 291 sets covered by the survey only seven are to have two boilers per turbine; all others have one. No house turbines are reported. Heat release rates are moderate, the commonest ranging from 14,000 to 20,000 B.Th.U./hr/cu ft. for coal fired boilers. Pulverized coal is mainly used for firing.

There is increasing use of "pressurized" furnaces, 37 being included. Eight boilers have dual circulation and 20 controlled circulation. Cooling towers will be used for at least 50 new units. Indoor plants continue to predominate, though 58 semi-outdoor and 38 completely outdoor stations are scheduled.

In 1948 the proportion of hydro to total power amounted to 40 per cent; last year it had fallen to 26·5 per cent of the total of 398,000 million kWh generated, although nearly 2,000 MW of hydro capacity was installed last year. The world's largest pumped storage unit is being installed by the Tennessee Valley Authority for its Hiwassee plant, where a new 70 MW generator will, when required, drive its turbine as a 3,900 cu ft/sec pump.

VIEWS on the NEWS

By REFLECTOR

BY a combination of adverse circumstances last December a dreadful fog persisted in London for two or three days and it had serious effects upon some of the inhabitants. Remembering this occurrence some people, including the daily newspapers, have this year expressed volubly and frequently the fear of another one like it this year. What I am leading up to is this: anybody who knew London forty years or more ago will remember that such fogs as last year's were quite customary. It is a tribute to electricity and gas (I will give our rivals their due) that a dark yellow fog in London is now so infrequent as to be news. Nevertheless there is still too much solid fuel consumption in London and still great scope for electricity and the City Corporation's steps towards the establishment of a smokeless zone is a recognition of this situation.

* * *

According to a report in the *Manchester Evening News* there has not been a single request from council house tenants in either Mossley or Saddleworth for an electric cooker—they all prefer gas. Strange? The North Western Electricity Board thinks so too, for it has asked Mossley to make sure that their tenants have "freedom of choice." This little Lancashire textile town nestles in a valley beneath the heights of Hartshead Pike which is said to have been a beacon site in the days of the Armada. Perhaps that may explain the town's predilection for the naked flame.

* * *

An unusual adaptation of an electric fire to spirit operation is described by a correspondent to the *Motor Boat* (Mr. G. H. Buckle). The appliance in question was a reflector type fire with a pencil element. Mr. Buckle cut a slot in the base of the reflector and inserted a methylated spirit heater consisting of a horizontal copper tube in the upper part of which he silver-soldered eight ½in wick tubes in a row. With this arrangement the heated air was carried up and over the element causing it to glow and presumably to throw out its heat by virtue of the parabolic reflector. I would say that such a conversion is an expensive heating method but it may suggest to electric fire manufacturers that motor boat owners are possible (if not very probable) customers.

* * *

I am one of those who rejoice that electric power stations, unlike gasworks, can be structures worth looking at. There are others who contemplate without a shudder huge corrugated iron boxes for housing power plant and contemptuously refer to modern generating stations as "cathedrals." Therefore I read with pleasure that Messrs. Cecil Howitt & Partners have received from the Royal Institute of British Architects its bronze medal for the best building completed during the past three years in Nottinghamshire, Lincolnshire and Derbyshire. The building in question is the Staythorpe power station.

* * *

Beacon, the magazine of the B.E.A. North Western Division, reports an interesting experiment in art appreciation upon which the Division has embarked. In ten of the Division's staff canteens reproductions of pictures, including "modern" paintings, are to hang on the walls for a period and the opinions of the staff have been invited. The pictures will be circulated in sets of six and each set will remain in position for about three months. It is said that Lord Citrine has authorized a central "pool" in London and so other Divisions will probably participate in the scheme. Comparatively small expense is involved and so there should be no cavilling at this cultural activity of the B.E.A.

PERSONAL and SOCIAL

News of Men and Women of the Industry

WITH effect from 1st January next **Mr. R. H. Weir,** at present Director of Engine Research and Development, will officiate as Principal Director of Engine Research and Development in the Ministry of Supply. He will succeed **Air Commodore F. R. Banks,** C.B., O.B.E. (ret.), who will then be released from charge of aero-engine development and return to his company the Associated Ethyl Co., Ltd. Air Commodore Banks will remain a consultant to the Ministry on aero engines.

Mr. P. Rhodes is retiring from the position of London area manager of the Hoffmann Manufacturing Co., Ltd., on 31st December next, after thirty-two years' service with the company. He will not be leaving the company's service for some time so that he can assist his successor in taking over his wider duties. **Mr. S. G. M. Shallard,** M.B.E., A.M.I.Mech.E., who has been his deputy as London area manager, will succeed Mr. Rhodes.

Mr. J. Pepper, establishment officer of the East Midlands Electricity Board, has been elected vice-president of the National and Local Government Officers' Association and will be next year's president.

Mrs. I. M. Bolton, who has been elected chairman of the London County Council, is the wife of Mr. D. J. Bolton, M.Sc.(Eng.), M.I.E.E., of the Commercial Department of the British Electricity Authority, and formerly of the Regent Street Polytechnic and the Ministry of Fuel and Power.

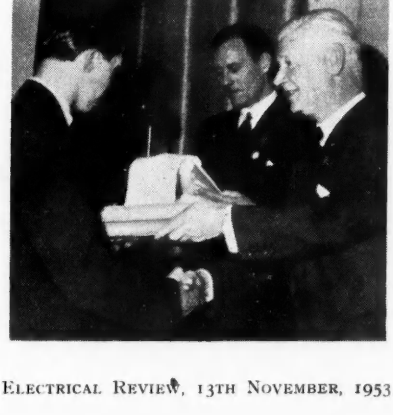
Mr. H. G. Sturgeon has been appointed an additional director of Ultra Electric (Holdings), Ltd.

Mr. H. H. Spencer, M.I.E.E., left London by air on 6th November, on behalf of Crompton Parkinson, Ltd., for a tour of Venezuela, Colombia, the Dominican Republic, Cuba, Mexico, and throughout the Caribbean area, with a view to expanding the company's selling organization and to prepare the ground for future trade.

Bruce Peebles & Co., Ltd., announce the following appointments, with responsibility to the general manager:—**Mr. V. P. Mackay,** Associate I.E.E., manager, Rotating Plant Department; **Mr. R. W. Flux,** A.M.C.T., A.M.I.E.E., manager, and **Mr. D. H. Smith,** B.Sc.(Eng.), A.M.I.E.E., chief designer and deputy manager, Transformer Department (Mr. Mackay and Mr. Flux were previously chief engineer of the respective departments); **Mr. O. L. Robson,** M.B.E., B.Sc.(Eng.), M.I.E.E., manager, Rectifier Department. He was previously chief rectifier designer.

The annual conversazione, in connection with their education scheme, was held by **W. T. Henley's Telegraph Works Co., Ltd.,** at Woolwich Polytechnic on 7th November. Mr. Jack Crump, the manager of the British athletic teams at the 1948 and 1952 Olympic Games, was the principal speaker. In opening the proceedings, Dr. P. Dunsheath (director) welcomed the distinguished guests, students and parents, and reviewed the scope of the education scheme and the facilities which it provides. Sir John Dalton (chairman of the Henley Organization) then presented the awards granted to students for examination successes. A presentation was made to Mr. E. Guy, Principal of the Gravesend Technical College, to mark the occasion of his retirement. Dr. Dunsheath handing him a portable typewriter. Mr. S. J. Palmer, a fourth year student apprentice training at Henley's Gravesend works, conveyed the students' thanks for the assistance given to them. A students' handicraft exhibition is an annual feature of the event, and once again this display included many excellent examples of

One of the successful students receiving his award from Sir John Dalton



the students' work. The challenge trophy and other awards for handicrafts were presented by Mr. J. H. Savage, manager of the company's North Woolwich Works. In the evening there were demonstrations of wrestling, weight-lifting and fencing. Films of international tennis tournaments were also shown, and a wide variety of sports equipment was on display. A dramatic presentation, produced by Mr. F. Davis of the Henley Research Laboratories, received an enthusiastic reception. A cast of members of the Henley Organization and friends from local dramatic societies staged a pageant of British history, music, drama and comedy, entitled "Coronation Cavalcade."

Mr. H. Rowe, founder and director of H. Rowe & Co. Pty., Ltd., Melbourne, Australia, gave a dinner on 4th November at the Savoy Hotel to twenty-five executives of the British electrical manufacturing companies that his company represents in Australia. Mr. D. D. Walker, joint managing director, Evershed & Vignoles, Ltd., proposed the health of Mr. Rowe and thanked him for the service that he had rendered to British exporters, and Mr. M. J. Gartside, chairman and managing director of the Rheostatic Co., Ltd., mentioned the assistance that British manufacturers could give their overseas agents by paying regular visits to study local market conditions.

Mr. Rowe expressed his company's appreciation of the support which had been given in the early days by its English principals. Mr. D. Dawson, Dawson Bros. (Shipping), Ltd., organized the dinner on behalf of Mr. Rowe and presented him with a gift from his guests to mark the occasion. Among those present were representatives from Evershed & Vignoles, Ltd., Dorman & Smith, Ltd., Venner, Ltd., Edison Swan Electric Co., Ltd., Berry's Electric, Ltd., T. Tinsley & Co., Ltd., the Rheostatic Co., Ltd., Geo. Bray & Co., Ltd., Tinsley (Industrial Instruments), Ltd., Brentford Transformers, Ltd., British Physical Laboratories, and Bastian & Allen, Ltd.

On 30th October, **John Godden (Stoke), Ltd.,** gave a dance, whist drive and buffet supper to some 250 guests connected with the electrical industry, at the Grand Hotel, Hanley, Staffs. This occasion was of special interest as it also celebrated Mr. John Godden's fiftieth year in the electrical industry, and during the evening the staff of his company presented him with a radiogram, and several of the guests gave him some gramophone records. Flowers were presented to Mrs. F. E. Woodward, the co-director of the company. Gifts were also presented by the Edison Electric Co., Ltd., the B.T.H. Co., and Philips Electrical, Ltd. These were competed for during the evening on behalf of the Electrical Industries Benevolent Association, and a sum of £11 18s was raised.

Upon the occasion of their annual outing the directors and employees of the **Humber Electrical Engineering Co., Ltd.,** electrical contractors, Hull, visited the works of the Benjamin Electric, Ltd., and M.K. Electric, Ltd. At a luncheon in Edmonton the company included Messrs. N. Shuttleworth, G. Raahauge and W. Downing, directors of the Humber Co., H. G. Campbell and A. E. Iliffe of Benjamin Electric, and R. W. Dowsett, A. E. Sales and R. C. Coombes of M.K. Electric.

Nearly 200 awards were made to employee-students of the **British Insulated Callender's Cables, Ltd.,** Further Education Scheme during a ceremony at the company's Prescot Works, Lancs, on 23th October, which was attended by 650 people, including relatives and friends of the successful students.

The awards were presented by Mr. D. W. Aldridge (director), deputizing for Mr. H. J. Stone (director and deputy chief executive), to students who had successfully taken courses at the B.I.C.C. Day Continuation School at Prescot, or at local technical colleges.

The dinner of the football section of the **Plessey Social and Sports Club** was held on 23rd October at the Valentine Hotel, Ilford, and was attended by well-known men in the business and sporting world. The speakers included Mr. T. White Wilson, executive director of the Plessey Co., and others present were Sqdn.-Ldr. A. E. Cooper, M.P. for Ilford South, and Parliamentary Private Secretary to the President of the Board of Trade, Mrs. Cooper, Mr. B. A. Campbell, Warden of the Peel Institute, Mrs. Campbell, Mr. Arthur Rowe, manager of the Tottenham Hotspur Football Club, and Mr. B. G. W. Attwood, director of the Plessey Co.

The carnival dance of the Birmingham Branch of the **Electrical Industries Benevolent Association** held at Magnet Club, Witton, on 9th October, realized £211. The annual general meeting of the Branch, preceded by a luncheon, will be held on Friday, 4th December, at the Imperial Hotel, Birmingham. Applications for tickets (12s 6d each) should be made to Mr. L. Wall, hon. secretary, c/o Electrical Components, Ltd., Ludgate Hill, Birmingham, 3.

OBITUARY

Mr. Frank H. Corson, M.I.C.E., M.I.E.E., whose death took place at Pitchcombe, Glos, last Friday, was for thirty-five years, until his retirement in 1944, city electrical engineer and general manager of the Gloucester electricity undertaking. Mr. Corson went to Gloucester in 1909, nine years after the city's electricity works were opened.

He was due to retire in 1941 but his services were extended from year to year until he was succeeded in 1944 by Mr. Emil Braathan. Mr. Corson was entirely responsible for the construction of the city's £1,300,000 generating station opened in 1943. He was president of the Gloucester Rotary Club in 1927-28.

Mr. Cyril John Sarjeant, who before his retirement in 1949 for reasons of health, was manager of the Control Gear Engineering Department of the British Thomson-Houston Co., Ltd., died on 3rd November. Mr. Sarjeant was born in 1891, and was educated at St. Mary's Church Schools, Balham, and Battersea Polytechnic. He joined the B.T.H. Co. in 1911 as an assistant in the Test Department. After service in the 1914-18 war, he rejoined the B.T.H. Test Department, and a few months later transferred to the Control Gear Engineering Department. In 1925 Mr. Sarjeant went to South Africa to supervise the installation of the 3,000 V d.c. automatic substations for the South African Railway electrification scheme. He was appointed manager of the Control Gear Engineering Department in 1947.

The late Mr. C. J. Sarjeant

Mr. A. O. Holder, South Wales manager for Walsall Conduits, Ltd., for the past twenty-two years, died on 25th October.

WILLS

Mr. W. Wigley, radio and electrical engineer, Wolverhampton, who died on 17th June, left estate "so far as can at present be ascertained" valued at £7,196 gross (£5,154 net).

Mr. W. L. Lumb, a director of the radio and electrical firms of W. L. Lumb, Ltd., of Hebden Bridge and Todmorden, and Lumb (Patmos), Ltd., who died on 11th January, left £18,733 gross (£18,408 net).

Mr. W. O. Fenwick, D.F.H., M.I.E.E., technical editor of the *Electrical Review*, who died on 29th August, left £7,019 gross (£6,954 net).

Mr. P. J. Watts, O.B.E., M.I.E.E., formerly for some years superintendent electrical engineer at H.M. Dockyard, Gibraltar, previously electrical engineer at Whitehaven, and chief assistant electrical engineer at Devonport Dockyard, who died on 31st July last, left £11,918 gross (£11,862 net).

Mr. W. J. Terry, chairman and managing director of London Electric Wire Co., and Smiths, Ltd., managing director of the Liverpool Electric Cable Co., Ltd., a director of the Vactite Wire Co. and a former chairman of the Cable Makers' Association, who died on 27th July, left £114,789 gross (£108,737 net).

Sir Harry Edwin Haward, one of the original Electricity Commissioners, who died on 8th September, left £25,918 gross (£24,430 net).

Mr. W. Symes, manufacturing consultant to Associated Electrical Industries, Ltd., and late director of the Metropolitan-Vickers Electrical Co., Ltd., who died on 18th May, left £19,626 gross (£19,487 net).

Mr. H. A. Lingard, lately a director of the British Thomson-Houston Co., Ltd., who died on 18th April, left £11,369 gross (£11,148 net).

Electrical Luncheon Club

A SMALL gathering of electrical men met at the Connaught Rooms, London, on Tuesday to discuss the formation of an Electrical Industry Luncheon Club. The meeting was convened by Mr. A. B. Wildsmith (Director, E.W.F.); he was supported by Sir John Dalton and Sir Henry Self. It was unanimously agreed to form a club. Mr. W. E. Babb (B.E.A.M.A.) was elected hon. secretary, Mr. H. F. Wickham (E.W.F.), hon. social secretary, and Mr. H. S. Fothergill, hon. treasurer. The following were elected as members of the committee:—Sir John Dalton and Messrs. J. J. Thompson, J. Mortimer Hawkins, R. Baldwin, N. H. Codling, E. G. Batt, A. S. Lowe, J. H. Campion, H. de A. Donisthorpe and E. B. Sawyer. It was decided that the Committee should hold its first meeting on 27th November with Mr. Wildsmith in the chair.

PRICES OF MATERIALS

IN the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £150 0s 0d
COPPER, H.C. Electro	ton £232 0s 0d
Fire Refined 99·70 per cent ..	ton £231 0s 0d
Fire Refined 99·50 per cent ..	ton £230 0s 0d
COPPER Tubes	lb 2s 3½d
Sheet	ton £293 10s 0d
H.C. wire and strip	ton £265 10s 0d
LEAD, English	ton £93 5s 0d
Foreign	ton £92 0s 0d
MERCURY	flask £61 15s 0d
TIN	ton £620 0s 0d
ZINC, G.O.B. Foreign	ton £74 0s 0d
Electrolytic	ton £75 10s 0d
BRASS Tubes	lb 1s 10½d
Sheet	ton £237 10s 0d
Wire	lb 2s 6¼d
PHOSPHOR BRONZE	
Wire	lb 3s 8¼d
RUBBER, No. 1 R.S.S. spot ..	lb 1/6½-1/6¾d

I.E.E. Liverpool Dinner

AT the annual dinner of the Mersey and North Wales Centre of the Institution of Electrical Engineers at Liverpool on Monday, Mr. Thomas Alker, Town Clerk of Liverpool, said that although the taking of electricity supply from local government and private enterprise might have been the proper policy, it was no criticism to say that consumers had been deprived of two safeguards, the element of competition and the ability of local representatives to turn criticisms into immediate policy. In that kind of atmosphere the professional integrity of members of the Institution was of ever-growing importance. The future well-being of humanity was in the hands of those who made electricity their profession.

Mr. T. E. Goldup, vice-president of the Institution, commended the work of the Institution in connection with National Certificates and quoted statistics of entries and the proportion of passes as evidence of their value to the profession. He congratulated the Mersey Centre on having completed thirty years of existence with membership of 1,200.

Mr. E. W. Ashby, past chairman of the Centre, said there was an urgent need for closer connection between research and the application of the results of research and discovery to industrial practice. What was achieved by research in universities and technical colleges should be more quickly translated into action. The Institution and sister institutions were doing their best to co-operate with the Minister of Education in this important matter. Relations with the mechanical and civil engineers' organizations were closer than ever before. Mr. Ashby also made sympathetic reference to the death of Mr. W. O. Fenwick, technical editor of the *Electrical Review*.

The Lord Mayor of Liverpool, Ald. W. J. Tristram, replied to the toast of the guests.

World Power Conference

THE scope of the sectional meeting of the World Power Conference to be held from 25th July to 8th August next year at Rio de Janeiro, Brazil, is indicated by the subjects of eleven papers to be presented by British authors, as arranged by the Papers Committee presided over by Sir John Hacking (B.E.A.). These deal with: Integration of hydro and thermal electric power in Great Britain by J. D. Peattie (B.E.A.) and A. A. Fulton (North of Scotland Hydro-Electric Board); wind power plants, E. W. Golding (E.R.A.); refinery equipment for tropical and sub-tropical areas, E. le Q. Herbert (Shell Refining & Marketing Co.); production and refining of shale oil, G. H. Smith and D. Stewart (Scottish Oils); British developments in gas turbines by Sir Harold Roxbee Cox (Ministry of Fuel and Power), A. T. Bowden (C. A. Parsons) and R. J. Welsh (English Electric), sponsored by B.E.A.M.A., and by Prof. W. R. Hawthorne (Cambridge University); carbonization and gasification in tropical and sub-tropical regions, J. F. West (West's Gas Improvement Co.); boiler design and availability, W. F. Simonson (Water-tube Boiler Makers' Association), sponsored by Boiler Availability Committee; power in agriculture, W. H. Cashmore and H. J. Humblin (Nat. Inst. of Agricultural Engineering); thermal cycles for power generation, Prof. O. A. Saunders (London University); power from vegetable wastes, A. Parker and T. F. Hurley (D.S.I.R.); design of electrical equipment for tropical climates by members of B.E.A.M.A., edited by H. Astbury (Crompton Parkinson).

Other British delegates will include Sir Vincent de Ferranti (chairman of International Executive Council and of British National Committee), J. Houston Angus (Electricity Corporation of Nigeria), Major J. Caldwell, S. Chaplin (Enfield Cables), C. H. Curtoys (Reyrolle), S. de Ferranti (Ferranti), G. F. Kennedy (Kennedy & Donkin), C. H. Pickworth (Preece, Cardew & Rider), A. J. V. Underwood, C. R. Westlake (Uganda Electricity Board) and C. H. Gray (secretary, International Executive Council and British National Committee).

For the final week visits have provisionally been arranged by bus and plane to places of technical interest. The cost of the visits will probably be about £70 each person. Preliminary notifications of attendance should be sent without delay to the secretary, W.P.C., 201–2, Grand Buildings, Trafalgar Square, W.C.2.

Lamp Prices Increased

INCREASED list prices for electric lamps were announced on Tuesday by the Electric Lamp Manufacturers' Association. The price of 40 W and 60 W clear and pearl single-coil lamps has gone up 1½d to 1s 4½d (plus 3d purchase tax), the coiled-coil type being 2d dearer at 1s 9d (plus 4d P.T.).

Other increases are as follows:—75 W single-coil 2d to 1s 10d (plus 4d P.T.); 75 W coiled-coil 3½d to 2s 1½d (plus 4½d P.T.); 100 W single-coil 1d to 1s 10d (plus 4d P.T.); 100 W coiled-coil 1½d to 2s 1½d (plus 4½d P.T.); 150 W single-coil 1d to 2s 7d (plus 5½d P.T.).

Internally silica coated lamps:—60 W single-coil 1½d to 1s 7½d (plus 3½d P.T.); 60 W coiled-coil 2d to 2s (plus 4½d P.T.); 100 W single-coil 1d to 2s 1d (plus 4½d P.T.); 100 W coiled-coil 1½d to 2s 4½d (plus 5d P.T.); 150 W single-coil 1d to 3s 1d (plus 6½d P.T.).

These prices are for 200–260 V lamps; prices of 100–130 V lamps and lamps in the various coloured finishes have been correspondingly increased.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Absorption and Compressor Refrigerators

WITH regard to the notes under the heading "Refrigeration" on pages 835 and 836 of your Domestic Electrical Equipment issue dated 16th October, there are four points on which I would wish to comment.

In referring to absorption type machines you state: "These machines have the advantage of absolute quietness in operation." I would point out that hermetic sealed compressor type equipments are so silent in operation as not to cause any annoyance to their users.

You say the consumption of the absorption machine is at least twice that of the compressor type. This is an understatement of the facts, as for a given cubic capacity the consumption of an absorption machine is some four to five times that of the compressor type.

You state: "Probably the most noticeable technical development has been the greatly increased number of absorption models now being manufactured." The fact is that the greatest technical development in the last few years has been that of the hermetic sealed system. Further, your statement is hardly borne out by the schedule which forms part of the article, where the details cover 32 models of 12 manufacturers of compressor type machines, as against seven models of three manufacturers of the absorption type. As you may be aware, in the last few years a number of small firms have for short periods engaged themselves in the industry generally without success, in an attempt to manufacture absorption machines.

Finally, to suggest that the use of wooden cabinets is an innovation is of course quite wrong. In the earliest days of the manufacture of domestic refrigerators, wood was used, but to-day the universal practice throughout the world is to supply steel cabinets.

May I also point out that the use of a domestic refrigerator operated by a hermetic sealed system enables the user to obtain an equipment of much smaller dimensions than are required by an absorption type equipment of similar effective cubic capacity, this being a very important consideration having regard to the restricted space which is generally available in the kitchen.

London, W.C.2.

E. G. BATT,
Director and Secretary,
British Refrigeration Association.

Lamps for Street Lighting

YOU have been generous in granting space for this most important topic. May I request a little more to discuss one or two points arising out of the latest correspondence?

Mr. Pulvermacher queries my figures of fluorescent street lighting costs and advances costs based on his own experience. I am inclined here to stick to my guns (and costs) and merely comment that probably neither of us is in a position to quote fully representative figures; we must rely on particular cases to make our point and hope that others will reinforce our argument through their own experience. My information is that the cost of columns, column erection and lantern maintenance is not substantially different for sodium or fluorescent, and certainly I see no good reason why it should be.

In any event the figure of 19s which stands between us is unlikely to tip the scales one way or the other. The final choice clearly rests on the question of relative suitability and I cannot accept the view that there is any special merit in yellow light sufficient to offset the advantages of natural colour rendering. (Incidentally I cannot even begin to understand the reasoning behind the Continental devotion to yellow headlamps.) Finally may I say that, although Mr. Pulvermacher, as myself, is sticking to his guns, I have a

shrewd suspicion that the gulf between us is not really very wide.

Mr. Ravenscroft has administered another of those kicks to which engineers are becoming accustomed. On this occasion, however, I feel that his strictures need examination. It is bad enough that he considers the use of advanced optical systems designed specially to provide contrast by silhouette, and hence to provide long distance visibility, as nothing better than devices to produce glare and ruin contrast, but it is even worse that he should himself propose, as an ideal solution, a form of lighting which is not only incapable of realization in practice but, if it could be achieved, would produce precisely that destruction of contrast of which he complains.

There is a niche in the Hall of Fame for the man who can devise a street lighting installation which meets the requirements for good road visibility after dark without the use of visible light sources. Until this miracle maker appears among us we must make the best of the intractable laws of optics. One of these laws is that to produce a uniformly bright road surface requires light sources of large area whose images in the road form the background against which everything on the road is seen. If Mr. Ravenscroft will explore some of the recent installations of fluorescent street lighting he will find many contributions of an imaginative and creative nature and he will see how well roads can be lighted when the scientist, the optical expert and the engineer work in concert, as is more often the case than he apparently realizes.

Highgate, N.6. W. ROBINSON.

I MUST apologise for returning to the lists once again, but I am afraid Mr. Cole has not appreciated the point I wish to make regarding the colour of sodium lamps. In my previous letter I was criticizing Mr. Robinson's statement on page 776 of your 9th October issue, that fluorescent street lighting gives better visibility per lumen delivered on the road than other forms of lighting. This implies that the monochromatic light of sodium is a disadvantage compared with fluorescent, whereas I wish to make the point that although there was little to choose there was in fact a slight balance in favour of sodium. This balance would, of course, be offset if a filter was used to provide the monochromatic light instead of its being a natural condition of sodium lighting. In the case of sodium, of course, there is no additional power input to produce yellow light.

I agree with Mr. Cole that the compulsory use in France of a yellow headlamp is a matter in which personal prejudice comes into play, and if the lumen outputs of yellow and white headlamps are the same then the glare will also be equal. I think it would be helpful if it was recollected by all participants in this controversy that my contention is that, from the economical aspect, sodium lighting is superior for the lighting of main traffic roads, but that when it is necessary to take amenities into account then a lamp giving a white light should be used. Whilst not wishing to be thought an iconoclast I do think that the amenity value of a white light has a tendency to be over-emphasized.

Pentyrch, Glam. F. H. PULVERMACHER.

IN your issue of 30th October we had a "highland lament" from Mr. John D. Ravenscroft that the lengthy correspondence on this subject has failed to produce "some denouement of practical value." He goes on to say that "the whole subject is one of optics."

Contrary to popular opinion the "bawbees" are watched very carefully down South and here, at least, the major factor in the problem is the economic one. The optician may provide the theoretically ideal solution but the average engineer is trained to produce the "denouement of practical value."

Bromley, Kent. E. H. JESTY, A.M.I.E.E.

Selling Electric Cookers

THE article in your issue of 16th October greatly interested me, for I have had very many years as an electricity supply company representative, selling and hiring out electric cookers, and very many months on various housing estates in keen competition with gas company representatives. My conclusions are that the hire of cookers is much too expensive; all-in domestic tariffs with a 1d per unit charge are excessive; lady demonstrators do not give their lectures and demonstrations in enough detail, and when calling on consumers put on too much "side" and are in too

much of a hurry to get away. Their knowledge is obtained from books.

Consumers will not go to the expense of purchasing new utensils, with ground bottoms, which are absolutely necessary with electric boiling plates. In many cases 30ft of wiring is installed free, but any excess must be paid for. Consumers do not like this as the gas industry invariably installs everything free of cost.

Cooking by electricity above ¾d per unit (plus the standing charge) is dear in comparison with gas.

I trust the various Electricity Boards will take notice of these few remarks and not think that their representatives are not trying, or are inefficient.

St. Mary Cray,
Kent.

C. V. DAVIES.

PARLIAMENTARY NEWS

By Our Special Reporter

AS reported in our last issue, the Queen's Speech opening the new Session included the statement that a Bill would be introduced to reorganize electricity supply in Scotland. Proposals for carrying out Government policy for television development would be laid before the House, as would also proposals for the transfer of responsibility for atomic energy from the Ministry of Supply to a statutory corporation.

Mr. Attlee, in the subsequent debate, said that the proposal to transfer atomic energy to a statutory corporation was bad. Atomic energy was of supreme importance, both from the point of view of defence and economics. It did not seem advisable that policy in this matter should be handed over to people who were not responsible to Parliament.

Mr. Hayman criticized the proposal to place a television transmitter on North Hessary Tor, Dartmoor.

Sir Harold Roper welcomed the proposal to reorganize electricity supply in Scotland. He was disappointed that there was no mention of electricity supplies for rural England.

Atomic Power

Mr. Nabarro asked the Minister of Supply what steps he was taking to secure a measure of collaboration between British and American scientists and engineers responsible for their respective nuclear power projects and interchange of data and information, in view of the almost simultaneous constructional periods of the breeder reactor designed for a capacity of approximately 50,000 kW in Britain, and the similar reactor shortly to be commenced in the United States and designed for a capacity of 60,000 kW.

Mr. Sandys said that the Government had on a number of occasions informed the United States Administration that, in the field of atomic energy, it would welcome collaboration on a reciprocal basis. However, the United States Atomic Energy Commission continued to be precluded by legislation from any effective exchange of information on these matters.

In reply to a further question Mr. Sandys said that pockets of uranium ore occurred in Cornwall but the quantities so far found would not justify the expense of mining and treatment.

Polythene Plastics

Mr. Ian Winterbottom asked the Minister of Supply if he would give an assurance that the discovery made by Dr. Charlsby at Harwell, that the nature of polythene plastics was affected by high-energy radiation, which had important commercial applications, had been protected by suitable patent applications.

Mr. Sandys said that research work conducted at Harwell under the direction of Dr. Charlsby had revealed that the properties of certain plastics, in particular polythene, polystyrene and neoprene, were improved by irradiation in a nuclear reactor. In accordance with normal practice, patent rights had been applied for.

Mr. Winterbottom asked if the Minister was aware that such was the interest aroused in America by these discoveries that the first inquiry reached Dr. Charlsby within fifteen days of the publication of the paper on the subject, that the General Electric Company of America at once took it up, and that it was in limited production by that company. Could he say what licence fee was being paid by the American exploiters of this discovery, and what steps were being taken to encourage British industry to use it?

Mr. Sandys said he was not in a position to answer the first part of the question. As to the second part, this information was being made freely available to British industry, which, he had no doubt, would be just as quick off the mark as American industry.

Domestic Heating Elements

Comparisons of Different Classes of Alloys

COMMENTING upon Mr. H. Hodges' article on heat resisting alloys (*Electrical Review*, 18th September, page 607), Mr. A. M. C. Murphy, A.Met., F.I.M., works manager, Hall & Pickles, Ltd., Ecclesfield, Sheffield, says that while dealing with known characteristics of 80/20 nickel-chromium alloys, the article embraces also certain comparisons with iron-aluminium-chromium alloys, of which " Kanthal " is the outstanding type. The fact that the comparisons and inferences are misleading and perhaps misinterpretations of the facts, cannot be allowed to pass without remark.

Comparative Performance

In the introductory remarks reference is made to the pre-eminent and unequalled usage of iron-aluminium-chromium types at high temperatures, i.e., above those permissible with 80/20 nickel-chromium alloy. It is a natural and well-established corollary that they give equal or better service at comparable temperatures, at the same time displaying characteristics of density and electrical resistance which render them economically attractive when compared with 80/20 nickel-chromium alloy used at the same temperature, not only, as suggested, as furnace elements, but very largely in domestic appliance applications, similar to those using 80/20 nickel-chromium alloy.

Figs. 1 and 2 indicate not so much a comparison of the alloys, but reflect upon the inherent or basic fire-bar design when operating with two materials whose mechanical properties at high temperature differ to a degree which can only be adversely reflected when design is subordinated to production policy.

When careful thought and design are reflected in proper and adequate ceramic support the appearance of the form of the element after long service of any domestic fire bar is comparable with 80/20 nickel-chromium alloy. Similarly the design, as illustrated, of element diameter and helical form, leaves much room for adverse criticism under normal conditions, let alone those for test comparison.

While this is not intended to be a comprehensive survey of the many acceptable characteristics of iron-aluminium-chromium alloys, such as " Kanthal," Figs. 1 and 2 very clearly illustrate the industrially recognized cleanness of the refractory after long periods of service, a feature which is very beneficial in industrial applications such as pottery work, as well as being attractive from the domestic aspect, when compared with the expected green/black oxide deposition characteristic of any fire bar using nickel-chromium alloys, and as evidenced in Fig. 1. These oxides of the basic elements, incidentally, result in quite appreciable current leakage, which is minimized with the " Kanthal " types.

Life Testing

A whole treatise could be written on life testing, and whilst the high life resulting from accelerated life testing of 80/20 nickel-chromium alloys is acknowledged, the test as outlined in the paper is not considered to be a good one. So far as nickel-chromium alloys are concerned, there are basic aspects of the accelerated life test for electrical heating put forward under A.S.T.M.B.76–39, which cannot be condoned. Fundamentally, the load, 35 lb/sq in, designed to be within the limiting creep stress of 80/20 nickel-chromium alloys at, initially, 1,066 deg C, has never been altered to meet the increased temperature of test to 1,177 deg C and as cited 1,232 deg C, in an endeavour to keep the test down to about 100 hours. One can but postulate in this note that the effect can but be misleading in so far as it is now more probably a mild form of hot tensile test and not a test of the resistance to heat.

Certainly the test as put forward has been and can only be applied to 80/20 nickel-chromium alloys. What justification there is for applying it to 65/15/20 nickel-chromium-iron alloy is problematical. It is sufficient to point out that under comparable conditions, i.e., where due

regard is given to mechanical strength such as obtains when the same test excluding the " appended weight " is made, i.e., the test specimen fixed at top and bottom, the life of iron-aluminium-chromium alloys far exceeds that of 80/20 nickel-chromium alloy.

Perhaps a criticism of the test data will be allowed, in so far as quotations of wire " lives " against A.S.T.M.B.76–39 test temperatures are liable to be misleading. A typical quotation is ". . . it is not now uncommon to record lives of 400 hours at 1,177 deg C and occasionally lives of 700 or 800 hours. . . ." A reader is liable to think that the wire remains at the nominal temperature for the whole period of test, whereas such conditions apply only during an initial period. Subsequently, it is the voltage that remains constant but, with progressive resistance increase, the wire temperature gradually falls and toward the end of a test started at 1,177 deg C, the wire temperature may drop by some 50 deg C or 100 deg C—a feature found to be typical of all makes of the 80/20 nickel-chromium quality. Further, the initial constant temperature period is recommended under A.S.T.M.B.76–39 to be adjusted to the starting temperature after five hours and twenty-four hours, whilst Mr. Hodges suggests only two hours, following which constant voltage is maintained.

Under the above conditions, it is apparent that such a limitation of the portion of the test life at 1,177 deg C not only makes comparable tests impossible, but tends to the development of apparently extended lives which is misleading.

AUTHOR'S REPLY

Mr. Hodges has been shown these criticisms and replies as follows:—

It was not the author's wish or intention to make misleading remarks or comparisons regarding the properties of the aluminium-chromium-iron alloys. Within their limits these alloys are a valuable complement to the nickel-chromium alloys, a fact recognized by the leading manufacturers, namely, A. B. Kanthal, Sweden, who themselves manufacture and market both " Kanthal " and nickel-chromium alloys. Mr. Murphy's own company follows the same policy.

It is not true that an alloy which makes a better heating element at temperatures above 1,150 deg C, necessarily makes a better heating element at lower temperatures. The argument in paragraph 2 is based on faulty reasoning, since quite different considerations govern the choice of heating elements for domestic apparatus from those which govern the choice of an element for, say, a high temperature biscuit pottery kiln.

Mr. Murphy admits that the inferior mechanical properties of the aluminium-chromium-iron alloys at high temperature make it necessary to reconsider the whole problem of support and protection of the element from thermal and mechanical shock. This only underlines what the author said but did not over-emphasize.

The A.S.T.M. Test B.76–39 measures the oxidation resistance of the wires under intermittent heating conditions and the small weight is intended only to keep the wire straight during test. In fact a weight many times that used could be sustained for the 100-hour test period at the temperatures in question. This test is recognized internationally as a good basis for comparison of nickel-chromium and nickel-chromium-iron alloys. The author did not suggest it should be used to test the aluminium-chromium-iron alloys, nor did he make any comparisons based on this test.

The author apologizes for his mistake in stating that the test temperature is re-set after two hours; it should, of course, have read " after five hours."

Surge Tank Design

AT a general meeting of the Institution of Mechanical Engineers on 6th November, Dr. C. Jaeger (English Electric Co.) summarized present trends in surge tank design with special reference to underground hydro-electric stations. The prime cause of surges he attributed to sudden changes in electrical load, the full impact of which was thrown upon the hydraulic system. New and difficult hydrodynamic problems were created where the tail race instead of being a free flow tunnel was under pressure, wholly, intermittently or partly. Amplitude of surges, turbine regulation and surge tank stability had then to be examined afresh, each case presenting different problems. Typical examples were considered of the effect of severe load changes and consequent complex interactions when machines were running in parallel. Precautions instituted at Loch Sloy to cope with possible disturbances were described. Relationships between surges, water hammer and turbine governing were discussed in the light of recent tests on large power stations and of modern theories.

Co-ordination of Insulation

Discussion on I.E.E. Paper

DURING the discussion that followed the paper by Mr. J. S. Cliff on "The Co-ordination of Insulation of High Voltage Electrical Installations," at the Institution of Electrical Engineers, reported in our issue of 6th November, Mr. F. J. Lane (B.E.A.) said that in general the policy of the B.E.A. was not to use lightning arrestors on the 132 kV system, since the expenditure involved, approaching £1,000,000, would not be justified. This was shown not only by the data in Dr. Forrest's paper on "The Performance of the British Grid System in Thunderstorms" but by the statistics for 1948–51, during which 164 lightning incidents had occurred, all believed to be associated with overhead lines. The total number of rod-gap operations had been 15, or about 7 per cent of the total of circuit interruptions, so that arrestors would not have reduced the circuit interruptions by more than 10 per cent. There had been only six instances of damage to transformers, and the costs due to breakdown had been small compared with the capital cost necessary to prevent them. Moreover, faults due to the arrestors themselves would probably have amounted to two or three a year.

Underground Systems

Mr. F. C. Winfield (Merz & McLellan) expressed the opinion that on an underground system the circuit breaker remained the principal generator of trouble. Two circuit breakers by different makers but conforming to British standards might have two different standards of attack on the insulation, because they generated entirely different voltages. The omission of a limit on the voltage generated by a circuit breaker was a serious one and should be remedied.

Mr. E. C. Rippon (C. A. Parsons) mentioned that British transformer makers had now adopted a document based on I.E.C. insulation classes which would shortly be discussed by the B.S.I. In it transformer insulation would be related to the highest system voltage, classes of insulation would be established and the impulse test level would be a withstand type test. It was recommended that the amplitude of surges reaching the transformer should be limited to 80 per cent of the withstand value.

Mr. W. G. Hawley (B.I.C.C.), commenting on the apparatus insulation levels recommended by the I.E.C. and the protection levels given in Table 10 of the paper, remarked that there did not seem to be a sufficient margin of safety between the two.

Mr. H. Leyburn (Reyrolles) suggested that the combination of rod gaps to protect transformers and automatic reclosing circuit breakers would be better than surge divertors. Automatic reclosing would take care not only of lightning faults near the substation but of transient faults on the system, at a low cost.

Overhead Lines

Mr. A. M. Thomas (E.R.A.), who, with Mr. D. F. Oakshott (B.E.A.), had been preparing a review of insulation co-ordination with special reference to overhead lines, said that international agreement on insulation co-ordination had not got much further than the production of recommended insulation levels applicable to station apparatus; these levels were based on the characteristics of surge divertors. It was puzzling that users of rod-gap protection found these insulation levels acceptable, but one explanation might be that the steepness of surges conducted into stations by overhead lines had been overestimated by the advocates of surge divertors.

Mr. G. B. Harper (B.E.A.), suggested that the reductions in insulation levels recommended by the I.E.C. up to 72·5 kV seemed hardly warranted. He doubted whether they would result in any material saving in capital cost of equipment. Typical figures for one year in this country showed that lightning incidents on 33 kV circuits

were four times those experienced on 132 kV, and for 11 kV circuits the figure was more like forty. Moreover, with the lower voltage systems a far larger number of small transformers was involved and adequate surge protection became more difficult.

Mr. R. H. Golde (E.R.A.) questioned the author's statement that protector tubes did not provide adequate protection for transformers and said that protector gaps, especially if fitted with external shields, had quite good flashover time-lag characteristics; they were superior to rod gaps for insulation co-ordination and avoided supply interruption.

Mr. K. Dannenberg (E.M.P. Electric), referring to the peak residual voltages given in Table 6, said that both in this country and abroad the high figures given were a long way from being reached; peak residual voltages were continually going down. In support he gave figures obtained by an independent testing station for a British divertor, which must greatly affect the protective level of insulation.

Mr. A. J. Gibbons (B.E.A.) said that the author, in dealing with cable networks, completely dismissed switching voltages. There were occasions, however, when switching voltages of very considerable magnitude occurred.

Mr. J. H. Mason (E.R.A.) emphasized the need for designers to consider processes of continuous degradation of insulation, and in this connection mentioned the tuned circuit a.c. discharge detector and dispersion meter suitable for detecting small traces of moisture in insulation, designed by his colleague Dr. Mole, which were now in commercial production. Moisture could be deleterious, he said, by causing both local thermal instability and reduction in the discharge inception voltage.

Mr. D. M. Cherry (B.E.A.), reinforcing Mr. Winfield's remarks on the need to limit switching over-voltages, pointed out that with a star-delta transformer the surge voltage generated by switching out appeared on the l.v. and h.v. windings equally in proportion to the turns, so that a tolerable over-voltage on the h.v. side might over-stress the l.v. side.

The author briefly replied, and Dr. L. G. Brazier advocated a partnership between the manufacturer and the user to explore how far insulation levels could be brought down without endangering the system.

Mobile Radio Systems

SOME aspects of the design of v.h.f. mobile radio systems not connected to the public telephone service were discussed by Mr. E. P. Fairburn (G.E.C.) in a paper presented on 11th November before the Radio Section of the Institution of Electrical Engineers. Five frequency bands had been allotted to this country for the purpose, which extended from 71·5–72·8 to 165–184 Mc/s with channels spaced at 50 kc/s in the lower first three and 100 kc/s in the other two. Lower frequencies covered larger areas better, especially in hilly districts. Mobile transmitter output powers were limited by the capacity of car batteries and charging sets and were normally from 10 to 20 W, but 3 to 5 W was used in the simpler schemes to reduce costs. Quartz crystals were always used to control frequency.

After describing methods of operation, the author dealt with modulation. For mobile systems the uniform frequency response and low distortion attained by frequency modulation was not required and amplitude modulation was more attractive for simpler systems, which worked on wide bandwidths and receiver inputs of a few microvolts and in which selective calling was not required. The simplicity of the spaced carrier system had not been equalled by corresponding f.m. systems and it required less bandwidth. Mixed schemes were sometimes justified in which a.m. was used between fixed and mobile stations and f.m. for fixed links because of its high signal/noise ratio, low distortion and advantages in switching and signalling. With growing congestion of available frequency bands a reduction in channel spacing was likely.

Means were described for securing adequate selectivity and avoiding blocking, cross-modulation and spurious radiation and responses. The paper concluded with a brief note on valves, which had to tolerate a range of heater voltage of ± 14 per cent on the nominal 6·3 V. A specification for amplitude modulated sets, drawn up by the Post Office in collaboration with the Radio Communication & Electronic Engineering Association, provided an appendix to the paper.

Private Generating Plant

Parallel Running Arrangements

A MEMORANDUM on technical aspects of the parallel operation of privately owned generating plant with Area Boards' systems has been prepared by the British Electricity Authority in association with the Federation of British Industries and the National Union of Manufacturers.

When the consumer's generator is of the synchronous type, synchronizing equipment would be installed at the point at which the generator is connected to the Board's system. It should be operated by a man competent to appreciate changes in electrical conditions. At voltages above 650, generators will be operated as three-phase three-wire machines, which provide no path for circulating third harmonic currents, provided the neutral is earthed at one point only.

Where the generator supplies loads between one phase and neutral, it must produce a sinusoidal wave to permit the connection of its neutral point to the Board's neutral. When third harmonics are appreciable it will require to be operated as a three-wire machine with a balancing transformer having a rating one-third of that of the generator. Since generators of less than 100 kW cannot in general be designed economically with sinusoidal characteristics, it is rarely practicable for them to run in parallel with the Board's networks, except from a substation supplying one consumer, though even then third harmonic currents may cause excessive heating. Automatic voltage regulation of the generator may be necessary to keep the Board's voltage within statutory limits.

Asynchronous (induction) generators present only problems associated with compensation for low power factor, which can be provided by capacitors or synchronous motors. Compensated induction generators, however, can be obtained to operate independently of the supply mains, the power factor being adjusted by varying the position of brushes on a commutator. Uncompensated machines cease to generate if the outside supply should fail. The load of a d.c. generator cannot be exported to a Board's a.c. system except through rotary or motor convertors.

Protective arrangements must ensure the immediate disconnection of a consumer's generator if defective or if a fault on the Board's system would cause it to feed into the fault. Usually reverse power relays would be required with a lower setting in one direction. For large generators balanced protection provides more rapid disconnection than does overload protection against a generator fault.

Neutral earthing arrangements have to comply with the Electricity Supply Regulations, 1937, in accordance with the requirements of each case. High voltage synchronous generators may not have their neutrals earthed when in parallel with the Board, but while operated in isolation they must be earthed either directly or through a resistance matched to that of the Board. Earthing will need to be automatic in certain circumstances, which will call for a voltage transformer on the consumer's generator. At medium voltages no earthing resistance will be required as the systems are commonly earthed, but means of isolation of the Board's neutral from the generator neutral and independent earthing of the latter when necessary must be provided.

Paralleling of a consumer's generator must not impose a short-circuit duty on either party's switchgear in excess of its assigned rating and sectionalizing of the installation may be requisite.

Courses for Power Engineers

A SERIES of courses for shift charge engineers, assistant charge engineers and boiler house charge engineers is being held at the British Electricity Authority's residential training centres at Horsley Towers (Surrey) and Buxton. The subjects include combustion problems, aspects of boiler design, developments in turbo-generators, maintenance and overhaul. Talks are also given on cost control and safety as well as on matters of a more general character.

Testing Directional Circuits

Method of Establishing Correct Connection

By J. H. TOULE, B.Sc., A.M.I.E.E.*

PRELIMINARY tests on circuits which include directional instruments, such as relays, wattmeters and watt-hour meters, usually fail to check the principal feature, namely direction. Until the circuit is put into commission, it cannot be established whether wattmeters are reading forward and relays operating or restraining for a given direction of power flow. It is very often inconvenient to shut down and reverse the necessary connections, while, in the case of relays, the load available may be insufficient to give a positive operation or restraint to the directional element.

A method has therefore been developed that will establish the correct directional connections during primary injection tests on the associated current transformer circuits. In principle, the method consists of feeding the voltage circuits and current transformers simultaneously from a common test transformer. The injection transformers used for this purpose have an output of 10–15 V for current supplies, with an additional voltage winding connected in series to give 63·5 V.

In order to prevent a back feed into the voltage transformer the fuses are removed and the polarizing supply is fed into the secondary wiring leading to the relays and meters. The point of current injection is chosen to simulate a single-phase power flow in the required direction. It may be most convenient to feed in at the busbar end of the circuit, with the line end short-circuited, in order to ensure operation of relays or forward movement of wattmeters. Watt-hour meters are frequently fitted with ratchet devices to prevent reverse rotation and the restraint condition of relays is more difficult to detect than a positive operation. Each successive pair of phases is tested in turn (R–Y, Y–B and B–R) so that each directional element is checked. Fig. 1 shows the connection for checking 30-deg movements as used for wattmeters and reverse power relays, while the inset illustrates the actual conditions in the meter windings for a single-phase load, which is represented by the test currents.

The point of application for the voltage test leads depends on the type of connection employed for the relay or meter. For

* B.E.A. South Western Division.

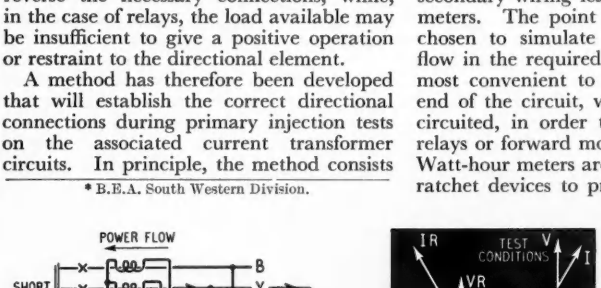


Fig. 1.—Test connections for checking 30-degree movements with (*inset*) actual conditions in meter windings, represented by test currents, for single-phase load

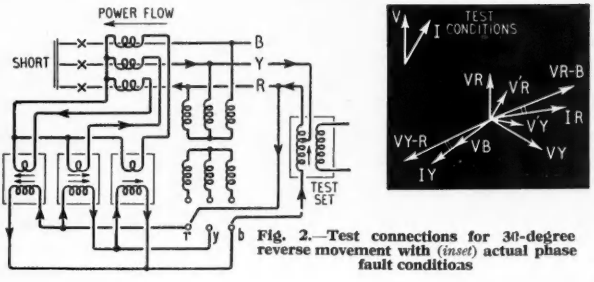


Fig. 2.—Test connections for 30-degree reverse movement with (*inset*) actual phase fault conditions

instance, a 30-deg reverse movement, as used in feeder directional relays, is shown in Fig. 2 with (inset) actual phase fault conditions; likewise, the 90-deg connection test conditions are shown in Fig. 3 with inset. It is important to establish which connection is employed before commencing the actual injection. This may be checked by testing out the voltage cores from the v.t. to the instrument or relay. Subsequently the voltages should be checked across the individual relays during the injection test.

By comparing these figures with those obtained at the point of injection, the connections will be confirmed. Table I makes this clear; for instance, the bottom line indicates that the blue phase element is receiving the full 44 V injected voltage. This shows that the blue phase current is combined with the R–Y voltage. In this way, taking each combination of phases in turn, all the voltage connections are confirmed. Because of the unsymmetrical burden of the voltage circuit, due to single-phase voltmeter connections and so forth, it will be realized that two of the phases are not sharing the voltage equally. Referring to the bottom line of Table I, the red phase relay receives 36 V while the yellow phase receives only 8 V, giving the total of 44 V.

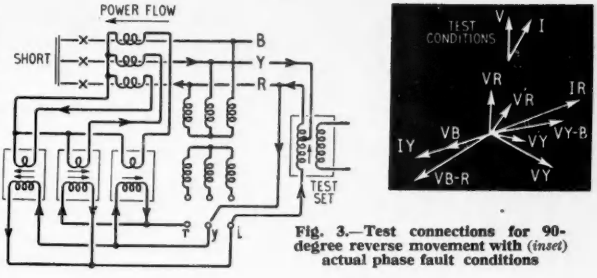


Fig. 3.—Test connections for 90-degree reverse movement with *(inset)* actual phase fault conditions

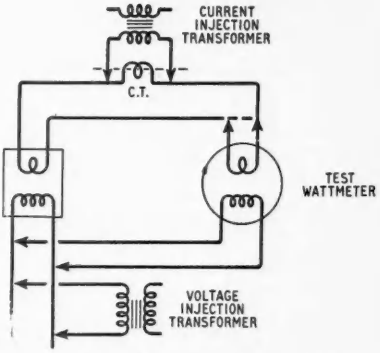


Fig. 4.—Connections for secondary injection

It is essential to mark the current and voltage injection leads to avoid a crossed connection which will give a negative result. The common point of the test transformer must be connected to the leading phase for current voltage in each case.

TABLE I.—TYPICAL DIRECTION TEST FIGURES

Power Flow, Busbar to Line													
Current Injection		Voltage Injection		Relay or Meter								Conn.	Remarks
				R Phase			Y Phase			B Phase			
Phase	Amps	Phase	Volts	A	V	D	A	V	D	A	V	D	
R–Y	200	r–y	44	0·2	44	—	—	—	—	0·2	6	F	30° Watt-meter
Y–B	200	y–b	44	—	36·5	—	0·2	44	—	0·2	7·5	F	
B–R	200	b–r	44	0·2	22	—	—	22	—	0·2	44	F	
R–Y	200	b–r	44	0·2	44	O	0·2	22	O	—	22	—	30° reverse Feeder Direction Relay
Y–B	200	r–y	44	—	8	—	0·2	44	O	0·2	36	O	
B–R	200	y–b	44	0·2	8	—	0·2	36	O	0·2	44	O	
R–Y	200	y–b	44	0·2	44	O	0·2	8	—	O	36	—	90° Transfer Direction Relay
Y–B	200	b–r	44	O	22	—	0·2	44	O	0·2	22	O	
B–R	200	r–y	44	0·2	36	O	O	8	—	0·2	44	O	

Key. A = Amperage
V = Voltage
D = Direction
F = Meters read forward
O = Relays operate

It may so happen in the case of high ratio current transformers that insufficient primary current is available from the test transformer to build up to the minimum operating current in directional relays. In this case it will be necessary to employ a second standard in the form of a multi-range wattmeter (Fig. 4) and repeat the test by direct injection into the relay itself.

With a given direction of power flow, the wattmeter voltage leads should be connected to give a forward reading. Without disturbing the wattmeter connections, sufficient current to ensure relay operation is injected from the test transformer into the appropriate c.t. secondary winding, with a polarizing voltage on the v.t. secondary circuit. It may be necessary to reverse the polarizing supply test leads to repeat the original wattmeter direction of rotation.

The tests described so far assume that there is no phase shift through the voltage transformer, since, for instance, the red phase (r) secondary lead is taken to represent the red phase (R) primary lead in phase if not in quantity. In order to prove this polarity a d.c. flick test must be carried out on the voltage transformer. A 6 V battery applied across two primary phases with a d.c. 0–120 mA meter across the appropriate secondary phase is sufficient to check all voltage transformers of the wound type up to 132 kV. If the results are set out in tabular form (Table II) there will be little possibility of error.

There is no difficulty in adapting an existing primary current injection transformer to include a polarizing winding as the latter need only be of small section. Normally, the polarizing coils of relays and meters take current of the order of 50–100 mA, but it is recommended that the winding be capable of 5 A short time

TABLE II.—FLICK TEST SCHEDULE

Primary						Secondary on making circuit					
R	Y	Y	B	B	R	r	y	y	b	b	r
+	−					+	−	−	+	−	+
6 volts						20 m/a		10 m/a		10 m/a	
		+	−			−	+	+	−	−	+
		6 volts				10 m/a		20 m/a		10 m/a	
				+	−	−	+	−	+	+	−
				6 volts		10 m/a		10 m/a		20 m/a	

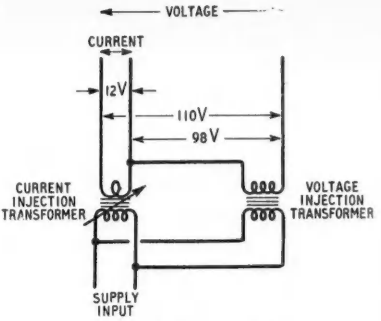


Fig. 5.—Test transformers

rating (i.e., 18–20 s.w.g.). The voltage rating should not be greater than 110 for phase connection. If, for instance, the injection transformer gives an output of 12 V with 15 turns, the extra polarizing turns required will be:—

$$\left(\frac{110}{12} \times 15 - 15\right) = 122{\cdot}5, \text{ say } 122 \text{ turns.}$$

If there is no available winding space on the injection transformer, or if the latter is of the induction regulator type which would give a variable polarizing voltage, it may be preferable to employ a separate polarizing transformer as is shown in Fig. 5. It is very important to connect the voltage secondary so that it is in phase with the current secondary; in other words, so that the voltages are additive.

The method described has been thoroughly tried out in practice and has proved invaluable in proving correct polarity connection in the testing stage and also in checking at the same time independent circuits, such as those of voltmeters, synchronizing circuits and so on.

Taiwan Development

WITH the first five-year plan for electric power development in Taiwan (Formosa) in operation, the Taiwan Power Co. is preparing a second five-year plan, to be centred around the Tachiachi Valley in central Taiwan. The plan aims to build generating plants with a total capacity of 460,000 kW. A second 26,500 kW hydro-electric set was officially put into operation on 8th September at the Tienlun power station in central Taiwan which is now the second largest of the island's chain of 33 thermal and hydro-electric generating stations. The Taiwan Power Co. plans to install a third set to raise the plant's output to 79,500 kW.

COMMERCE and INDUSTRY

Helping Exports to Canada

Nickel Restrictions Removed

THE British Standards Institution has set up a section to deal with the approval in the United Kingdom of air receivers, boilers and pressure vessels intended for export to Canada. Initially the B.S.I. and the chief of the Boiler Inspection Department of Quebec drew up arrangements to cover the necessary service and these have now been extended by agreement with the Canadian Standards Association's Committee on Canadian Boiler Regulations to all Canadian Provinces, whose chief inspectors have agreed to accept equipment manufactured in the United Kingdom provided that:—(1) the necessary registration with Canada has been effected; (2) the equipment has been constructed in accordance with the relevant Canadian specifications; and (3) the necessary inspection during and after construction has been carried out by an accepted inspection agency.

The B.S.I. section dealing with this matter has been set up in association with the B.S.I./C.S.A. Approvals Agency for electrical equipment so that it will be convenient for United Kingdom manufacturers of equipment that has to comply not only with the Canadian Electrical Code but also with the requirements of pressure vessels such as electrode boilers and electrically operated pressure vessel accessories. As the staff of this section of B.S.I. are familiar with conditions in the engineering industry in Canada, manufacturers are invited to apply to the Institution for full information and help.

C.S.A. Approved Equipment

The 400 manufacturers of electrical equipment who have now obtained approval of their products for export to Canada are listed in a publication which can be obtained free of charge from the British Standards Institution, British Standards House, 2, Park Street, London, W.1. This list, which classifies the products into categories such as machine tools, cleaning machines, medical and dental equipment, office appliances, refrigerators, food preparing machines, fans and blowers, heaters (air, cooking, liquid, industrial and laboratory), electric motors, switchgear, wires and cables, domestic appliances, etc., details as far as is possible the extent of the range of equipment covered, together with the firm's approval number and full name and address. There is also a large miscellaneous section which includes such diverse products as welding equipment, electric lighting plants, cathode-ray oscilloscopes, moulding presses, hydro-extractors and textile machinery.

The details of these 400 approvals, which do not include the 200 manufacturers whose approvals are at the moment incomplete, are contained in this 40-page publication, which will be supplemented quarterly by additional sheets, which will also be available free of charge from British Standards House. The list (ref. CR (ELA) 4015) will be found invaluable, not only by manufacturers wishing to obtain approved components for incorporation in their completed equipment being exported to Canada, but also by manufacturers contemplating entering the Canadian market.

Full information on the B.S.I./C.S.A. Approvals Agency is given in a booklet (ref. PD.1533) obtainable from the B.S.I., price 3s 6d post free.

F.B.I. Register, 1954

The "F.B.I. Register of British Manufacturers, 1954" (the 26th edition) is now available. This 950-page standard export reference book to British industry is the only authorized directory of the Federation of British Industries. It is widely used for finding reliable sources of supply, by importers, buyers, trade commissioners, Chambers of Commerce, commercial attachés, reference libraries, etc., throughout the world. The introductory information and detailed instructions on the use of the Register are in English, French and Spanish. Each of the seven sections has a reinforced index card for easy reference. A buyers' guide classifies over 6,500 F.B.I. member firms under more than 5,000 alphabetical trade headings, and full details of all these firms are given in a comprehensive alphabetical directory. Other sections provide useful information about trade associations, proprietary names, trade marks, etc.

The Register is published for the F.B.I. by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, at 42s (including postage).

Lighting for Efficiency

With the title, "Lighting for Efficiency and Productivity," the Birmingham and District Sub-Area of the Midlands Electricity Board is holding an exhibition for two weeks commencing to-day (Friday) at 247, Chester Street, Aston, Birmingham. The exhibition, in which the Electrical

Development Association is co-operating, is part of the M.E.B. series of exhibitions, "Electricity in Industry," and it is designed to be mainly educative and to assist industrialists with their particular problems. It is divided into two parts—general factory lighting and lighting as a production tool. The first part will include a display of modern electric lighting fittings, equipment for light measurement and the photometric control of factory lighting, and mains and l.v. local lighting, while the centre piece is a specially-constructed workbench provided with a variety of lighting fittings to illustrate the effect of various methods on working efficiency. The second part of the exhibition displays special applications of lighting, including lighting for colour matching, applications of the luminous stroboscope, photo printing, the applications of ultra-violet light in industry, a special device for the examination of polished surfaces, and also a new device for area measurement using photo-electric cells.

Appliance List Criticized

In our issue of 23rd October we reported that the Ministry of Housing and Local Government was circulating to housing authorities a list prepared by the British Electrical Development Association (at the request of the Ministry of Fuel and Power) of domestic electrical appliances which had been tested and approved by E.D.A. and the Electricity Boards. The Ministry recommended that only appliances in the list should be provided in housing schemes.

A protest against this action has been sent to the Ministry of Fuel and Power and the Association by C. H. Blackburn & Co., Ltd., London, W.C.1. The company points out that the appliances listed are supposed to have been tested by *all* the Electricity Boards. This is described as a cumbersome procedure and in any event it is contended that manufacturers should first have been invited to submit their claims for inclusion.

In its own case, the company says, its water heaters have been approved for more than three years by several Electricity Boards in the southern part of England but they are not included in the list. In view of this the Ministry of Housing recommendation is regarded as "a matter for considerable resentment."

Die Casting Handbook

A handbook, sponsored by the Advisory Committee (Die Castings), Ministry of Supply, has been compiled by Mr. F. D. Penney of the Ministry's Armament Design Establishment and is published by H.M. Stationery Office, price 6s. The handbook is intended primarily to assist the designer to appreciate the advantages and limitations of die casting processes and assess the suitability of a particular component for production as a pressure or gravity casting, etc., but it is also of value to those concerned with the production and inspection of die castings, both for the Services and for general use. It is fully illustrated.

S.W.E.B. Display Competition

The South Western Electricity Board's Area Display Competition has been won this year by the Tiverton Service Centre, which receives the challenge cup and first prize. Bristol North (Whiteladies Road) was second and Penzance third. The displays at Honiton, Barnstaple, Taunton and Nailsea were highly commended. The Tiverton display made ingenious use of flashing lamps and a clock face with a moving hand to draw the eye to the electric cooker and copy cards displayed in the window.

Overseas Exhibition Organization

At a recent week-end Export Sales Conference organized by the Federation of British Industries it was announced that the Federation had formed a subsidiary company, British Overseas Fairs, Ltd., primarily to run the British Trade Fair in Baghdad next autumn. It was thought that this company might well be used as a continuing organization to run, or assist to run, all-British shows elsewhere and perhaps to help particular trades to arrange composite shows within the appropriate sections of international trade fairs.

Electricity Supply Tables

The 1953–54 edition of the *Electrical Journal* Red Book, "Electricity Undertakings of the World," is now available from Benn Bros., Ltd., Bouverie House, 154, Fleet Street, London, E.C.4. The 63rd edition in the series, it includes much additional information with respect to the British Commonwealth while the details in the section dealing with foreign undertakings have also been expanded. This year there are also included the addresses of undertakings overseas as well as those in this country.

The changes chiefly concerned with the presentation of information and alteration in page design, introduced last year, have been maintained to facilitate reference. The price is 30s, including postage.

3-D Publicity

We have received from George Cohen, Sons & Co., Ltd., an illustrated leaflet showing their Canning Town depot, in which a three-dimensional effect is obtained with the aid of a viewer.

Large Model Cooker

The accompanying picture shows the stand of the South West Scotland Electricity Board at the recent Modern Homes Exhibition held in Glasgow. The large model cooker which

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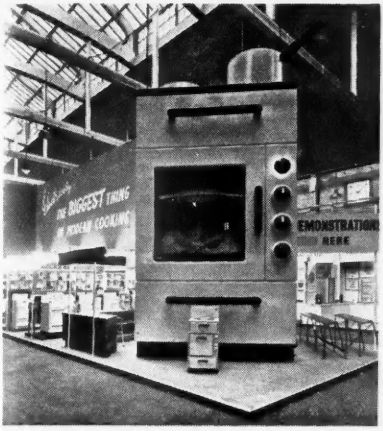


A large model cooker shown by the South West Scotland Electricity Board at the recent Glasgow Modern Homes Exhibition

formed the central feature of the display attracted much attention, and was linked up with the appropriate slogan, " Electricity, the biggest thing in modern cooking."

Electrical Engineers' Exhibition

The first meeting of the Council of Management of Electrical Engineers' (A.S.E.E.) Exhibition, Ltd., was held on 31st October, when the organizing committee and officials were appointed. The chairman of the Council is Mr. J. Flood; Mr. E. J. Sutton is chairman of the exhibition organizing committee; and Mr. P. A. Thorogood is shortly to take up the full-time appointment of general manager.

All communications regarding the 1954 exhibition should be sent to Mr. Thorogood at 35, Gibbs Green, Edgware, Middx. (telephone: Mill Hill 3528).

Works Visit

The Midland Section of the Institution of Gas Engineers held its autumn meeting at Wolverhampton on 30th October when Mr. G. M. Rimmer, M.I.E.E., M.A.I.E.E., electrical and mechanical engineer to the West Midlands Gas Board, read a paper entitled " Electronics in the Gas Industry." About 120 members attended the meeting after which they were guests of the Electric Construction Co., Ltd., at luncheon. Mr. W. M. Furniss, chairman and managing director, and Mr. E. W. Walker, director and Birmingham area representative, were present, and Mr. W. Macnaughton, president of the Midland Section of the Institution, presided. Mr. Macnaughton proposed the toast of the Electric Construction Co., coupled with the name of Mr. W. M. Furniss. He referred to the early developments of the company and also to the E.C.C. electrical equipment at the new Swan Village Gas Works. Mr. J. C. Milne, assistant general manager to the company, responded. Following the lunch members visited the E.C.C. Works at Bushbury and saw electrical equipment for the gas industry being manufactured.

Tungsten Ore Prices

Further reductions in the selling price of tungsten ores of standard 65 per cent grade and ordinary quality are announced by the Ministry of Materials. From 4th November the reductions are:—Wolframite from 270s to 245s; Scheelite from 255s to 230s per long ton unit delivered consumers' works.

Nickel Restrictions Removed

All restrictions on the use of nickel have been removed by the Board of Trade and the Ministry of Supply with effect from 6th November. The revoking Orders, the Nickel Prohibited Uses (Board of Trade) (Revocation) Order, 1953, S.I. 1953 No. 1605, and the Nickel Prohibited Uses (Ministry of Supply) (Revocation) Order, 1953, S.I. 1953 No. 1607, are on sale at H.M. Stationery Office. The Minister of Supply has withdrawn the Alloy Steel Directions restricting the use of nickel in the manufacture of alloy steels.

" Vital Sparks "

A booklet bearing this title has been produced by Editorial Services, Ltd., for the British Electrical and Allied Manufacturers' Association, 36, Kingsway, London, W.C.2. Its purpose is to counter the prejudice against electricity which has been fostered by certain interests and it deals with such subjects as the availability of plant; the nature of the coal used for electricity generation; room-heating methods; the availability and inexpensiveness of running electrical appliances; the adverse effects of purchase tax; the dependence of export trade in domestic appliances upon a healthy home market; the use of electricity on the farm; and the future of electricity supply in view of the development of atomic power.

The points are succinctly put and it is claimed that the booklet is not controversial—its purpose is to state a simple factual case for electricity.

New Electrical Showrooms

On 20th October James Scott & Co. (Electrical Engineers), Ltd., opened new showrooms at 109–111, High Street, Dunfermline. The company was formed in Dunfermline in 1908, with the title of Oliver Melville, Robb & Scott. The partnership was discontinued in 1920, and the late Mr. James Scott became the sole proprietor of the company. On his death in 1946 the concern was converted into a private limited

company with its present title. The first showroom was opened in Queen Anne Street, Dunfermline in 1924, and although it has been replaced by the new showrooms, the old premises are being retained as a radio and TV service depot. The new showrooms have a comprehensive display of domestic electrical apparatus and radio and television sets. In addition to its Dunfermline premises, the company has branches in Edinburgh, Perth, Glasgow and Dundee.

On 2nd November, Richard Attenborough, the actor, formally opened the new showrooms of Kendall's, electrical and radio engineers, of 63, High Street, Caterham, at 11, Croydon Road, Caterham. The new showrooms are of modern construction and display a comprehensive selection of electrical domestic appliances, radio and television equipment.

Special Domestic Issue

CLIFTON AIRCRAFT, LTD., Lytham, Lancs, should be added to the list of manufacturers of cookers, fires and non-automatic irons given in our Special Domestic Issue of 16th October, while the name of MAURICE CHESHIRE & Co., 215, Moseley Street, Birmingham, 5, should be substituted for that of CHALFONT ELECTRICAL PRODUCTS, LTD., Tyrrell Street, Leicester, as manufacturers of paint strippers.

The dimensions of the H. FISHER (OLDHAM) type "L" washing machine should have been given as 30in by 21in by 21in.

Trade Announcements

Associated Technical Manufacturers, Ltd., has removed its London office to 48, Woburn Place, London, W.C.1 (telephone: Museum 3808).

British Insulated Callender's Cables, Ltd., announces that, with effect from 23rd November, the address of its Bristol Branch will be 7-9, Barton Street, Bristol. The telephone number will be unchanged.

The **Exhibition Panel Service** (which has a finishing service for machinery exhibits) has moved to larger premises at 10a, Swan Street, Warwick.

Chamberlain Industries, Ltd., has appointed **Electricals, Ltd.,** 14, Claremont Place, Newcastle-upon-Tyne, 2, as its main distributors and stockists.

Mr. C. T. Ives has been appointed a representative of **Ekco-Ensign Electric, Ltd.,** covering parts of the south-western and western postal districts of London. He will operate from the company's southern sales office at 45, Essex Street, Strand, London, W.C.2.

The **Kenwright Electrical Co., Ltd.,** wholesalers, have opened a new demonstration showroom at 515, London Road, Thornton Heath, Surrey. Its purpose is the demonstration to the trade of electrical kitchen appliances, with emphasis on washing machines and auxiliary equipment.

Catalogues and Lists

Engineering Developments (England), Ltd., 1, Adams Place, Georges Road, London, N.7.—Leaflet illustrating the "EDM 105" illuminated magnifier and a catalogue covering the "EDM 400" range of probe illuminators.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—1953-54 "Osram" catalogue in three parts: lamps and tubes; battery type bulbs; photographic and projector lamps.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.—Folder illustrating a few of the special rectifiers recently supplied by Ediswan.

Sterling Cable Co., Ltd., Aldermaston, Berks.—Pamphlet dealing with the Sterling "Twintel" watertight joint box.

Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.—20-page priced catalogue of domestic electric appliances (797/53).

Acme Electric Co. (Finsbury), Ltd., 123, Hanley Road, Stroud Green Road, London, N.4.—Revised price list (No. 7) of electrical accessories, cables, appliances, iron, bowl and pencil elements, etc.

Benford, Ltd., The Cape, Warwick.—Illustrated priced catalogue of factory maintenance labour-saving equipment, including the "Little Benford" electrically driven concrete mixer.

Belling & Co., Ltd., Bridge Works, Enfield, Middlesex. — Illustrated priced folder of "Belling" cookers.

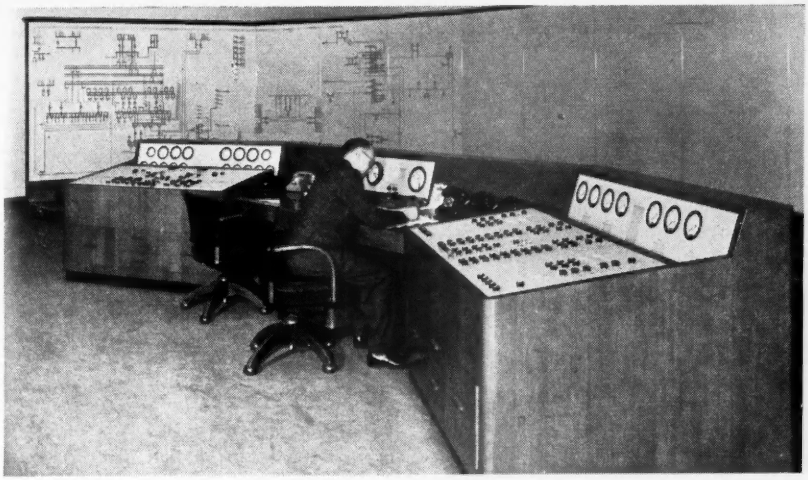
Newman Industries, Ltd., Yate, Bristol.—Catalogue illustrating the "Newman" range of electric motors.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Eicrite" cable duct.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.



Leeds Distribution Reinforcement

RAPIDLY increasing loads in the city made it necessary to reinforce substantially the 6·6 kV distribution networks in Leeds, and the Yorkshire Electricity Board has recently commissioned the first stage of a reinforcement scheme designed to increase the capacity of the existing 6·6 kV feeders. This scheme includes the establishment of two 33/6·6 kV substations in North Leeds, at West Park and at Fir Tree Lane, fed from Kirkstall power station, and two substations in South Leeds, at Church Street and Holbeck, fed from a new 132/33 kV substation at Low Road. This last-mentioned substation is supplied, in turn, by duplicate 132 kV overhead transformer-feeder circuits from Skelton Grange power station.

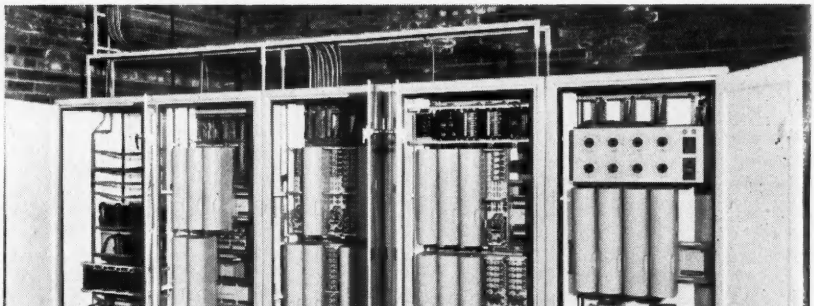
In parallel with this scheme is a plan to co-ordinate the operation of the high-voltage distribution systems in the Board's area, which envisages several system control centres situated at strategic points. These centres will be at main grid supply substations, so that these substations may be directly controlled. The first of the new system control centres has been installed at Low Road, Leeds, to cater for the operation of the 6·6 kV, 11 kV, 33 kV and 66 kV systems which are supplied from Kirkstall, Whitehall Road, and Ferrybridge power stations and from Low Road transformer station.

The systems are operated from the Low Road control room with the aid of a manually set wall diagram depicting the high-voltage systems in the area of control. In addition, several substations in Leeds are remotely controlled by means of a supervisory installation. The control operations are carried out from a desk, one wing of which comprises a miniature panel for the control of the local switchgear, whilst the other contains the "common" control panel for all the remote substations, of which there will be ten when the initial installation is completed, but the control panel is designed for 49 remote stations.

The local control equipment operates on a direct wire basis, but the system for the remote substations utilizes coded signals because of the limited number of pilot wires available. It embodies a "common diagram" principle wherein a single panel, incorporating the maximum number of each type of control or indication facility at any substation, can be associated at will with any substation by the operation on the control panel of the sub-station selection key designated for that station. Such a system enables the control station sending and receiving equipment to be common to all substations.

The maximum economy in pilot wires is attained by operating some of the remote substations via an intermediate pilot switch or "tandem" station, which obviates the necessity for separate pilot wires between each remote

Above: **General view of the control desk, with system diagram in background**



The suite of apparatus cubicles in Low Road substation

substation and the control station. The desk houses the local and remote control panels and occupies the centre of the control room facing the manually set wall diagram. The control diagram on the desk provides such facilities as circuit breaker control and indication, and indications of circuit breaker isolated, isolator and busbar selector positions, transformer tap positions, and miscellaneous alarm conditions. Selective metering of voltage and current is also provided.

The relay apparatus for the operation of the supervisory system is accommodated in totally enclosed steel cubicles below the control room, and each substation is equipped with similar steel cubicles which house the control apparatus for the individual substation. The whole of the supervisory remote control equipment was designed, manufactured, and installed by Standard Telephones and Cables, Ltd., in collaboration with the engineering staff of the Yorkshire Electricity Board. The equipment was officially handed over to the Board at an informal opening ceremony which took place in the control room at Low Road substation on 2nd November.

The Joint Iron Council

COMING so soon after the passage of the Iron and Steel Act, it was probably inevitable that there would be a political note running through the after-dinner speeches at the annual banquet of the Joint Iron Council in London last week. In their proposals of and responses to the various toasts, the president, Mr. F. Scopes, chairman, the Council of Iron Producers; the Minister of Supply, the Rt. Hon. Duncan Sandys, M.P.; the chairman of the National Coal Board, Sir Hubert Houldsworth, Q.C.; and the vice-president, Mr. N. P. Newman, J.P., chairman, the Council of Ironfoundry Associations, all contributed to this aspect.

Mr. Scopes expressed the industry's gratitude to the Minister of Supply for the manner in which he had piloted the Act through Parliament, and said that the most important developments of the past two years had been the provision of incentives to the industry.

Mr. Sandys made reference to the excellent relations which now existed between the Government and the industry, and he thought that perhaps the industry might bear a greater proportion of the cost of its research. At present the Government was contributing 40 per cent of this cost. He also announced his decision to abolish immediately the price controls over castings and forgings.

Sir Hubert Houldsworth said that the economy of the country rested on the efforts of all industries, not on those of a single industry. It was satisfactory that a nationalized industry could work in successful co-operation with a private-enterprise industry.

Derivation of Power Factor

Some Refreshing Conceptions

By A. G. POWELL, A.M.I.E.E.

IN developing ideas of power factor and reactive current, it is clearly essential to differentiate between the r.m.s. values of current and voltage (which are invariably meant when the terms are used in a quantitative sense without qualification) and their instantaneous values, the time relationships of which are of real significance in connection with concepts of power factor and wattless current.

Taking a simple two-wire circuit, and assuming sinusoidal voltage and current, the relationships of voltage, current and power under conditions of unity power factor are shown in Fig. 1. The power at any instant is equal to the algebraic product of the instantaneous values of the voltage and current at that instant, and the resultant curve, representing the total power flowing in the circuit is a sine curve and has a frequency twice that of the supply. As with unity power factor the voltage and current are exactly in phase, all values of the voltage will be in the same direction (and therefore have the same sign) as the current value at the same instant. This results in all values of the power curve being positive, indicating a flow of power in one direction only, i.e., " into the circuit."

It should be noted that the amplitude of the total power curve is indicative of the volt-amperes of the circuit, which value is the product of the r.m.s. values of voltage and current. The average value

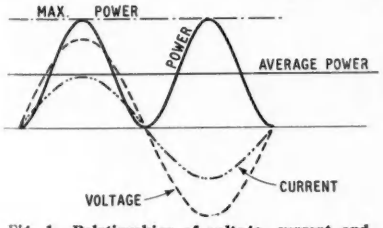


Fig. 1.—Relationships of voltage, current and power under unity p.f. conditions

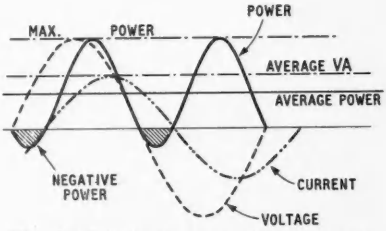


Fig. 2.—Instantaneous current and voltage values of opposite signs result in a negative portion of the total power curve, i.e., " from the circuit "

of the total power is equal to half the peak amplitude, and in the case of unity power factor to the volt-amperes (VA); for if the peak values of voltage and current are denoted by E_m and I_m the product of the r.m.s. values will be:—

$$\frac{E_m}{\sqrt{2}} \times \frac{I_m}{\sqrt{2}} = \frac{E_m \times I_m}{2}$$

Taking the case of the voltage and current being out of phase, i.e., the power factor being less than unity, then for some portion of the voltage and current curves their instantaneous values will have opposite signs, this resulting in a portion of the total power curve being negative, and signifying for this portion of the curve a power flow in the negative direction, i.e., " from the circuit." This condition is shown in Fig. 2. The amplitude of the power curve, with constant voltage and current, does not change with variations of power factor, i.e., the sum of the power is constant, disregarding the direction of flow. The extreme conditions are that of unity power factor, in which the whole of the power flows in one direction, and the watts = VA, and that of zero power factor, when the power curve is balanced exactly about the zero line and the average power is zero; in other words where the power flowing " into the circuit " is exactly balanced by

the power flowing "from the circuit." From this point of view a current of zero power factor is only wattless in the sense that the resultant transfer of power over a complete cycle is nil.

Power factor may be defined as the ratio of the average watts to the product of r.m.s. volts and amperes, which is the average value of the apparent power or volt-amperes.

An approach which lends itself to calculation and graphical methods of representation of a current of less than unity power factor, is to consider this as made up of two components, one in phase with the voltage and the other of zero power factor, the former carrying the whole of the power and the latter none. Similarly, there can be considered to be one current and the impressed voltage to have two components, one overcoming the resistance of the circuit and in phase with the current, and the other overcoming the e.m.f. due to reactance and lagging behind the current if this is capacitative, and leading it if inductive. Objections may be made to these conceptions: against the first on the ground that one current only really flows, and against the second from the fact that the voltage is impressed across the whole circuit and no complete separation exists in practice between the resistance and reactance of a circuit.

A more convincing idea is not to regard the voltage and current separately, but to consider the total volt-amperes as made up of two components, watts and reactive volt-amperes. This seems to be more acceptable than either the ideas of component currents or component voltages, because the three quantities concerned have more reality. The total volt-amperes is equivalent to the amplitude of the power wave, the watts equal to the net power transferred, and the reactive volt-amperes is a measure of the energy stored in the circuit to flow back in the reverse direction due to its inductance or capacitance.

With a three-phase circuit, unless conditions are similar in each phase with regard to the balance of voltages and currents, it is very difficult to obtain a clear picture of the circuit power factor in terms of phase differences between each line current and its associated voltage. The power factor of a three-phase circuit must therefore be an average of the conditions in the individual phases and may be defined as the ratio of the total watts to the total volt-amperes. Graphically, the volt-amperes is the hypotenuse of the right-angled triangle of which the watts and the reactive volt-amperes form the other two sides, and the power factor is therefore the cosine of the angle, the tangent of which is the ratio of the reactive volt-amperes to the watts.

Electrical Aids in Anti-aircraft Gunnery

DURING the last war many electrical devices were introduced to improve the accuracy and volume of anti-aircraft gunfire. Considerable effort is still being devoted to the improvement of these devices to keep pace with the increasing speeds and operational ceilings of modern aircraft. The development of such electrical aids was described last week by Mr. D. H. A. Huddart (B.T.H. Co.), when he presented a paper to the London Students' Section of the Institution of Electrical Engineers.

After discussing briefly the problems involved in anti-aircraft gunnery, Mr. Huddart described typical equipment and explained that early detection of the approach of a target was given by a long range radar set which radiated very high peak powers. Its aerial system was designed to permit the searching of large volumes of space quite rapidly.

The comparatively crude information thereby obtained was used to direct a narrow beam precision radar set on to the target, the movement of which it followed across the sky entirely automatically. The data thus obtained were transmitted to the predictor, which operated continuously to aim the guns correctly throughout the engagement.

The guns themselves were fitted with electrically-controlled hydraulic servo motors, which enabled them to follow the output from the predictor automatically. The cycle of loading and firing had been greatly accelerated by using electric motors to do the work formerly done by hand.

The proximity fuze, which caused the shell to explode provided it passed within a certain distance of the target, made a substantial contribution to the effectiveness of anti-aircraft fire. One such fuze contained a miniature continuous-wave radar system, in which the amplitude of the Doppler frequency component derived from comparing the frequencies of the transmitted and received signals was used to explode the shell at the correct moment.

ELECTRICITY SUPPLY

First Power Station in Mecca

Consumers and Tariffs

A LARGE crowd, including Princes and Ambassadors from Moslem countries, heard the Crown Prince of Saudi Arabia express his satisfaction that a public supply of electricity would now be available in the Holy City when he opened Mecca's first power station on 22nd October. The power station, which is equipped with four Mirrlees/Brush diesel generating sets, will supply electricity for street and house lighting and for industrial purposes. Until now there has been no general supply of electricity for the 100,000 population of the Holy City, though a few people have private power plants. The new power station is situated outside the walls of Mecca and equipment within the city has been installed by Brush-trained Moslem engineers since the city is not open to non-Moslems. There will be fifteen substations in Mecca itself. The capacity of the station is 3,740 kW, which will later be increased to 10,000 kW. The contract for the power station was obtained by Brush Export, Ltd., a subsidiary company of the Brush Electrical Engineering Co., Ltd., parent company of the Brush group.

Housing Development

The South West Scotland Electricity Board has approved schemes to provide a supply of electricity to 251 new houses at Mains (East) site, East Kilbride, at a cost of £14,254; 262 houses at Haldane, Balloch, £19,632; 312 at Faifley, Clydebank, £23,664; and 715 at Glenburn, Paisley, £32,216. In addition the Board has authorized a scheme to afford a supply to the National Coal Board collieries and works to the north and north-west of Dalmellington in Ayrshire. The estimated total demand for these collieries and works is 2,400–3,000 kW.

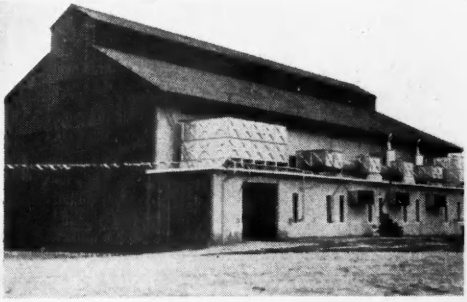
Amalgamation of Districts

As from 1st November the South West Scotland Electricity Board has amalgamated the Dumfries and Thornhill Districts of the Dumfries and Galloway Sub-Area, the combined district to be known as Dumfries District. The Moffat section, which was previously in the Thornhill District, has been transferred to Annan District.

Consumers' Complaints

The Southern Electricity Consultative Council met at Reading on 3rd November with Group Captain J. C. M. Hay, O.B.E., in the chair. The Council considered complaints received from the Wiltshire and Isle of Wight County Councils principally regarding the effect of the commercial tariffs on educational establishments and decided that no representation could be made to the Board at present but that the matter would be borne in mind when the tariffs came up for review. With regard to a letter received from the Town Clerk, Winchester, to the effect that the new commercial tariffs had

The Crown Prince (now King) of Saudi Arabia at the opening of the first power station in Mecca with members of the staff of E. A. Juffali and Bros., and representatives of the Brush Group



increased the cost of supply to the City Council buildings by 26 per cent, it was decided that no representation could be made to the Board. The bursar of Eton College complained that the boys' boarding houses previously assessed on the domestic tariff were now included under the commercial tariff with a consequent increase of some 48 per cent. The Council decided to consider this matter further when full details had been obtained.

Charge for Outstanding Accounts

Consumers in the Southern Electricity Board's area who do not pay their accounts until a representative of the Board calls to disconnect the supply have now to pay an additional charge. In reply to an inquiry by the Consultative Council, the Board explained that authority to make the charge for collecting outstanding accounts was derived from Section 2 of the Electricity Act, 1947, which gave Area Boards " power to do anything and to enter into any transaction . . . which in their opinion is calculated to facilitate the proper performance of their duties or the exercise or performance of any of their functions or is incidental or conducive thereto." Increased costs were involved and the Board felt that the general body of consumers should not be prejudiced by the failure of a proportion to pay their accounts in the normal time. The acceptance of payment at the time of supply disconnection was a concession not normally extended to the same consumer more than once.

New Battersea Power Station Chimney

The erection of the fourth chimney at Battersea " B " power station has now been completed. Work began on the 350ft high chimney in July last year. The smoke washing process takes place within the chimney shaft and tower and this, in conjunction with the heat and sulphurous fumes, would cause damage to concrete and steel not adequately protected or treated. Thus, although the new chimney looks exactly the same as the existing chimneys it incorporates improvements made in the light of experience.

Completion of the chimney represents the last stage of the constructional work carried out at Battersea for the British Electricity Authority by Taylor Woodrow (Construction), Ltd., other works, which were started in 1950, having included extensions to the boiler house, switch house and turbine house and a new office building.

Objection to Supergrid Lines

Worcestershire County Council decided on 2nd November to ensure that a public inquiry is held into the proposed super-grid overhead electricity line between Melksham and Hams Hall, Birmingham. The Council will object to the scheme on the grounds that the line would run through the Evesham area, which is " of high amenity and fertility value " and that the extension of the route over the Cotswolds would result in the 135ft high pylons being seen from a long way off.

Traders Protest

Following a debate on the new electricity charges at the monthly meeting of Huddersfield Chamber of Trade, a resolution was passed protesting vigorously against the new charges introduced by the Yorkshire Electricity Board and the lack of consultation with the trader. The system of taking into account floor space regardless of whether all the space was used or not was criticized.

Industrial Supply Terms

Last year the Eastern Electricity Consultative Council received representations from two large industrial concerns—Enfield Rolling Mills, Ltd., and Associated Portland Cement Manufacturers, Ltd.—regarding proposed increases in electricity charges. After full consideration the Council made various recommendations many of which were accepted by the Electricity Board. Further representations were, however, received from the companies and were referred to the Council's Tariffs Sub-Committee. At last week's meeting of the Council the chairman (Ald. W. J. Bennett) announced that a letter had been received from Enfield Rolling Mills stating that the company accepted the terms offered by the Board and thanking the Council for the understanding way in which it had listened to the company's representations. The chairman said that this was a very satisfactory ending to a difficult case. He added that the general question of the coal clause adjustment figure was being discussed with the Central Authority. With regard to Associated Portland Cement Manufacturers, it was stated that the company's representative and the chairman of the Board (Mr. C. T. Melling) had attended a meeting that morning at which this matter was further discussed and it would be the subject of a later report to the Council.

Hire of Appliances

On the suggestion of the Consultative Council's Chilterns Local Committee, the Eastern Electricity Board has agreed to examine the question of a simple hire scheme for such appliances as cookers and immersion heaters. At last week's meeting of the Council the chairman said that supply undertakings had been largely built-up on simple hire and he thought the time was coming when facilities would have to be made available for those who could not afford to buy electrical appliances. It had to be borne in mind, however, that with present-day costs, particularly of maintenance, hire charges would not differ much from hire-purchase terms.

FRENCH ELECTRICAL INDUSTRY

Expansion of Plant and Electricity Production

THE electrical industry of France has made great strides during the last two decades and the number of persons now employed (200,000) is practically double what it was in 1929. In his report on economic and commercial conditions in France (H.M. Stationery Office, 5s net), Mr. E. W. Meiklereid, C.M.G., H.M. Minister (Commercial) at Paris, says that on 1st January, 1952, there were 7,460 registered manufacturers of whom 1,593 contributed between them 92·3 per cent of the industry's total output and 35·8 per cent were artisan enterprises. The turnover of the industry in 1951 amounted to 354 milliard francs and in 1952 to 426 milliard francs. Exports have also increased considerably and were valued in 1952 at 48 milliard francs.

Power Plant Production

On the generation side, the capacity of thermal-electric plant in 1952 produced by French factories exceeded 1,000,000 kVA, whilst the capacity of hydro-electric plant produced was more than 750,000 kVA. The industry has also exported much important power plant equipment. The annual production capacity of large transformers now exceeds 6 million kVA, and many orders have been received from overseas. Production of relays and meters is now sufficient to meet most home needs and contribute to exports. All types of electric cable and wire are produced, the quality of most types being subject to standards established by the Union Technique des Syndicats d'Electricité. Exports reached 5·8 milliard francs in 1952. A wide range of electrical machinery for industry, domestic electrical equipment and electric heating apparatus is produced, all of which contribute to the export market. In the electric traction field equipment for electric traction units for mines and haulage as well as for trolley-buses is produced. The output of electrically-driven road vehicles, including trolley-buses, numbered 250 in 1950, and the output of electric trolleys in the same year numbered 750.

Despite the progress made by the electrical industry and the wide range of products produced, France continues to import a considerable amount of electrical equipment, especially alternators, transformers and convertors and distribution and industrial equipment. The total value of imports in 1951 was 18·3 milliard francs, slightly more than the total value of exports (16·1 milliard francs). Imports have steadily increased since the war, the principal supplier being the United States. Other important suppliers in 1951 were Germany, the Netherlands, Switzerland, Italy and the United Kingdom.

The expansion of electricity production has received special favour from the Government and has been one of the most striking achievements of post-war France. By 1951 hydro-electric production by the nationalized Electricité de France had reached a level more than double that of 1938, whilst production of thermal power had risen by just over 60 per cent. In 1952 total hydro-electric production rose by a further 6 per cent to 22·5 milliard kWh (17·5 milliard kWh contributed by Electricité de France). Consumption in the same year amounted to 40·8 milliard kWh (114 per cent above the level of 1938). The funds made available for capital investment in electricity production and spent in 1951 amounted to 122·8 milliard francs. The second Five-Year Plan is expected to make provision for continuing investment in and development of electricity production. A certain amount of the heavy and light electrical plant and equipment which has been used in the expansion of electricity production since the Liberation has been supplied from the United Kingdom. Mr. Meiklereid mentions some of the hydro-electric schemes in operation and the work carried out in improving the yield of the regular thermal power stations.

The distribution network of Electricité de France comprises about 300,000 km of h.v. lines, more than 15,000 km of inter-regional connecting lines, some of which are at present being operated well below capacity, and about 400,000 km of local lines. Recent developments have seen an extension of the 225 kV network, and to a lesser extent of the 150 kV lines, and a diminution in the 110–120 kV network.

Railway Electrification

The extension of electrification of the railways is designed to achieve greater efficiency and a saving of coal, but since the war the priority accorded to reconstruction and the high cost of equipment have made it impossible to carry out the electrification of more than 100 km a year. The most important of the post-war schemes has been the electrification of the Paris–Lyons line. The post-war achievements, although modest, have meant an annual saving of about 735,000 tons of coal. The only major operation planned for 1953 is the completion of the electrification of the Valenciennes–Thionville line, mainly for the carriage of coal and ore, which is expected to save a further 275,000 tons of coal annually.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Aircraft Cables

TWO new types of aircraft cables are available from BRITISH INSULATED CALLENDER'S CABLES, LTD., 21, Bloomsbury Street, London, W.C.1. One of them, known as "Nypren," is for use in place of "Pren" (a glass-braided, polychloroprene-insulated cable) when there is a possibility of contamination by the synthetic lubricating oil which is being used in jet engines. Its construction is basically the addition of a nylon covering to "Pren." The diameter of any "Nypren" cable has been made the same as the equivalent "Pren" cable by a slight reduction in the thickness of the polychloroprene insulation. At present these cables are only available in the smaller sizes, which are type approved to MoS Specification EL 1771 Issue I.

The other new cable, known as "Unifire," is designed for fire detection and extinguishing circuits and will operate in open flame at 1,000 deg C for not less than five minutes. The composite glass and asbestos insulation is impregnated with various silicone compounds. This cable is type approved to MoS Specification EL 1736.

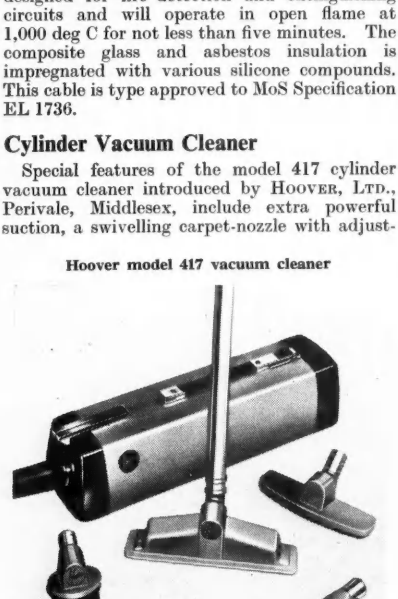
Cylinder Vacuum Cleaner

Special features of the model 417 cylinder vacuum cleaner introduced by HOOVER, LTD., Perivale, Middlesex, include extra powerful suction, a swivelling carpet-nozzle with adjustable brush, easier snap-fit connections, a fragrant air deodorant pad and the "Disposall" tough paper bag, which fits inside the normal dust bag to provide an easy and hygienic method of emptying.

The comprehensive range of cleaning tools comprises a flexible plastic swivelling floor-brush, a new-angle dusting brush with a flexible plastic nozzle, a special furniture nozzle, a crevice tool and snap-fit extension tubes.

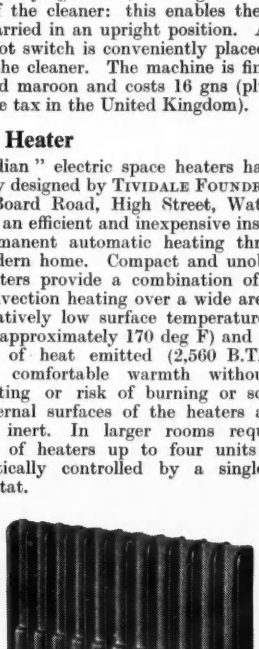
The cleaner is compact and light and can easily be carried, there being, in addition to the normal carrying handle, a lifting slot under the front of the cleaner: this enables the cleaner to be carried in an upright position. A simple press foot switch is conveniently placed on the top of the cleaner. The machine is finished in grey and maroon and costs 16 gns (plus 6 gns purchase tax in the United Kingdom).

Hoover model 417 vacuum cleaner



Space Heater

"Radian" electric space heaters have been specially designed by TIVIDALE FOUNDRY, LTD., Local Board Road, High Street, Watford, to provide an efficient and inexpensive installation for permanent automatic heating throughout the modern home. Compact and unobtrusive, the heaters provide a combination of radiant and convection heating over a wide area. The comparatively low surface temperature of the heater (approximately 170 deg F) and the high volume of heat emitted (2,560 B.Th.U./hr), ensures comfortable warmth without local overheating or risk of burning or scorching. All external surfaces of the heaters are electrically inert. In larger rooms requiring a number of heaters up to four units can be automatically controlled by a single 15 A thermostat.



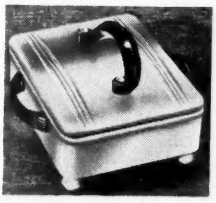
"Radian" space heater

The heaters are supplied in a single standard size, 20in by 12in by 3½in, with special mounting brackets for alternative wall or floor mounting, and may be instantly removed from these brackets without interfering with the installation. Both heaters and brackets have an attractive metallic finish harmonizing with any decorative treatment and are completely rust-proof.

The Metrovick 750 watt steel-sheathed heating element is cast into the single piece alloy body and the electrical connections are totally enclosed within a terminal box centrally fitted at the rear of the heaters. Every heater supplied carries a ten years' guarantee. The list price is £8 15s 0d (plus £4 11s 11d purchase tax in this country).

Horizontal Toaster

An electric toaster of unconventional design is now being produced by the INDUSTRIAL MACHINERY & APPLIANCE CO., 11, King Street, Wolverhampton. In this, the "Ten-Second" toaster, the bread is toasted by actual contact



"Ten-Second" toaster

between a pair of heated plates. The heating elements are clamped to the reverse side of the heating plate by means of a cast pressure plate. Alternatively the element may be actually embedded in the heating plate casting.

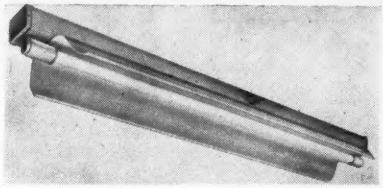
Loading is 900 W and a thermostat is incorporated adjusted to sustain the operating temperature for approximately ten seconds' toasting time.

The toaster has a polished and chromium finish and is fitted with heat-resisting plastic lifting handles and feet. All standard voltages are available between 110 V and 250 V and the retail price is £2 15s 0d.

Industrial Fluorescent Fittings

A complete new range of industrial fittings with fixed b.c. lampholders and employing the "Pendicone" suspension principle has just been announced by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.

Fixed b.c. lampholders permit instant re-lamping with either hand from either end of the fitting and the "Pendicone" method greatly simplifies installation. The range consists of



One of the range of B.T.H. industrial fittings

standard one- and two-lamp channels fully wired with either switch-start or instant-start control gear, together with channel covers to form bare-lamp fittings.

Open or closed ended reflectors are available, with or without upward light, in stove or vitreous enamel, "Perspex," and anodized aluminium. The chokes consist of B.T.H. "brick" type instant-start transformers encased in cast iron without any form of compound filling. "Permitol" capacitors are used.

Absorption Type Refrigerator

The new 1½ cu ft free standing model refrigerator brought out by ASTRAL EQUIPMENT, LTD., 96, Buchanan Street, Glasgow, C.1, has 3½ cu ft of shelf area and two ice trays making ¾ lb of ice. The absorption unit, which is suitable for a.c. or d.c. and is thermostatically controlled, consumes approximately 1·5 kWh per day. The external dimensions are: height, 36in; width, 20½in; depth, 21¼in. The exterior is constructed of zinc protected mild steel sheet, finished in white stove enamel. The frame has been formed entirely in one piece from high impact plastic, and no screws are visible externally. The door interior is in laminated plastic finished in white stove enamel. The bottom part of the refrigerator is available as ordinary storage space. The price is £32 6s 1d (plus £12 11s 1d P.T. in this country).

Astral 1½ cu ft free standing refrigerator

Financial Section

STOCKS and SHARES

THE rising curve of industrial share prices has tended to flatten out slightly, although there is little evidence of back-sliding, and plenty of activity and good features are observable in many sections of the market. Tube Investments' decision to pay proportionately the same dividend as for last year did something to modify optimism in other cases where share prices have been run up in anticipation of bigger distributions. Gilt-edged stocks are generally better. Quotations had been pegged down for a time by the fact that most Government issues could be tendered at fixed prices in payment for the new United Steel Companies share issue, the lists for which closed last Monday.

Six Months' Rises

With the industrial market apparently inclined to take a breather, the opportunity may be accepted to review the extent to which share prices have moved during the course of an aggressive six months' advance. In many cases the pace of the rise can fairly be described as startling. Some credit for it must be given to the reduction of the Bank Rate, which in the ordinary way reacts automatically on most high-grade securities. Most of it, however, can be ascribed to the recovery in the industrial production figures, and to a tendency towards some relaxation of the austerity imposed by events on company dividend policies during previous years.

Rise in Prices

The following table compares current prices with those of six months ago in the case of a number of popular electrical stocks and shares:

Stock or Share	Mid-May	Now	Rise
	s d	s d	s d
A.E.I.	80 0	42 6xb	5 0
Auto. Telephone ..	58 9	62 6	3 9
Babcock & Wilcox	64 0	72 6	8 6
B.I.C.C.	36 6	40 0	3 6
Brush	3 9	4 3	6
Chloride Electric ..	69 0	85 0	16 0
Crompton Parkinson	9 9	15 6	5 9
Decca	25 6	33 9	8 3
Hoover	21 9	26 3	4 6
L.E.W.	58 9	75 9	17 0
Lucas	38 9'	47 6	8 9
Parsons, C. A. ..	67 0	96 3	29 3
Reyrolle	56 3	77 6	21 3
Westinghouse ..	53 9	62 6	8 9
Cable & Wireless ..	136	146	10

Southern Areas Electric

A movement which has been attracting notice in the electrical equipment market is the persistent rise in the price of Southern Areas Electric £1 shares. They have not been so high as the present price of 18s for about four years past, during which time the quotation has been down to 6s. Activities of the group were reorganized after the nationalization of the electricity supply undertakings in 1948. From small beginnings, the annual accounts have shown since then an impressive expansion of the earning capacity in each subsequent year. For 1952, the distribution was raised to a well covered 6 per cent (including 1 per cent as bonus), which was better than the pre-nationalization rate.

Tube Investments Results

Anticipation of the Tube Investments final dividend and annual figures proved to have been over-confident, for the shares were marked down from 70s to 64s 6d on the announcements. Allowing for the share bonus distributed during the course of the latest year, the total dividend of 15 per cent is equivalent to the previous year's rate. Trading profits of £5·9 million compare with the 1951–52 earnings of over £9 million, of which £1 million is described as exceptional profit. The outcome is a net surplus of £3¾ million to cover the amount of £722,000 distributed in preference and ordinary dividends, leaving about £3 million to be added to the reserves. The still very impressive strength of the position is reflected in a yield of under 4¾ per cent on the shares.

Capital Proposals

Taylor Tunnicliff (Electrical Industries) 5s ordinary have been quoted at 21s 3d since the news of the company's intention to distribute a 100 per cent capital bonus from reserves. With the annual accounts issued earlier this year, the chairman reported the completion of most of the reconstruction schemes which, for some years, had dictated a particularly cautious dividend policy. The distribution was accordingly raised then from 20 per cent to a still well-covered 25 per cent.

Week's Changes

Among the industrial market leaders, English Electrics have been outstandingly firm. The official quotation remained at 58s 9d, but shares have been changing hands around £3. Other shares which may incidentally be mentioned as having been dealt in lately above their official list prices (on which the accompanying weekly tables are based) include Brook Motors, at 37s, Dewhurst, 6s, Marryat & Scott, 6s 1½d, and Newman Industries, 2s 7½d. Parsons

and Reyrolle shares have again advanced strongly, and other shares in favour include Plessey, Telegraph Condenser, Allen West, Siemens and Laurence, Scott.

Sturtevants are now quoted ex the rights to the new shares; the latter stand at 3s 7½d premium. Telephone Properties rose 8s 9d to 5⅝ on the decision of the Venezuelan Government to purchase the company's telephone interests in Venezuela.

Company	Dividend Previous	Dividend Last	Middle Price 9th Nov. 1953	Week's Rise or Fall	Est. Yield p.c.
Gilt-edged and Overseas Stocks			£ s d		
Brit. Elec. 1968/73	3	3	89½	+½	3 7 0
Brit. Elec. 1974/77	3	3	88½	—	3 7 10
Brit. Elec. 1976/79	3½	3½	93½	—	3 14 9
Brit. Elec. 1974/79	4½	4½	103½	—	4 2 0
Calcutta Elec. ..	6†	6†	19/-	—	6 6 4†
East African Power	7	7	22/-	—	6 7 3
Nigerian Elec. ..	10	10	23/6	—	8 10 3
Palestine Elec. "A"	5†	Nil	17/6	+6d	Nil
Perak Hydro-Elec.	Nil	6	14/6	−1/-	8 5 6
Equipment and Manufacturing					
Aberdare Cables (5/-)	20	25	8/9	+3d	7 2 9*
Aerialite (1/-) ..	83½	88½	10/-	—	8 16 8
Allen, W. H. ..	15	15	48/9	+1/3	6 3 0
Aron Elec. Ord. ..	15	20	42/6	—	9 8 2
Assoc. Elec. Ord.	20	20	42/6	—	4 14 3*
Automatic Tel. & El.	15	15	62/6	—	4 16 0
Babcock & Wilcox	18	18	72/6	+6d	4 19 4
Baldwin, H. J. (2/-)	20	20	4/-	−3d	10 0 0
Bakelite (10/-) ..	—	12½	24/6	—	5 2 1
British Aluminium	12	12	39/6	+9d	6 1 0
B.I. Callender's ..	9	10	40/-	—	5 0 0
British Thermostat (5/-)	30	35	18/9	—	—
British Vac. Cleaner (5/-)	25	25	13/3	−3d	9 8 9
Brook Motors (10/-)	20	20	35/-	—	—
Brush Ord. (5/-) ..	10	4	4/3	—	—
A. F. Bulgin (1/-)	30	30	3/3	—	9 4 6
Burco (5/-) ..	35	35	22/6	—	7 15 6
Chloride El. Storage	15	20	85/-	−1/3	4 14 3
Cole, E. K. (5/-) ..	25	25*	20/-	—	6 5 0
Cossor, A. C. (5/-)	10	10	7/3	+3d	6 18 0
Crabtree (10/-) ..	17½	17½	28/-	−6d	6 5 0
Crompton Parkinson Ord. (5/-) ..	11¼	20	15/6d	+3	6 9 0
De La Rue (5/-) ..	35	Nil	13/9	+1/9	—
Decca (5/-) ..	112½	150	33/9	−9d	4 9 0*
Dewhurst (2/-) ..	22½	19*	5/6	—	6 18 3
DictographTel.(2/-)	20	20	5/9	—	—
E.M.I. (10/-) ..	12	8	13/6	+3d	5 18 6
Electrical Components (5/-) ..	20	20	10/9	−6d	9 6 0
Elec. Construction	15	15	53/9	—	5 11 9
Enfield Cable Ord.	7½	5	23/-	—	4 7 0
English Electric ..	15	15	58/9	—	5 2 3
Ericsson Tel. (5/-)	22†	22*†	42/-	+6d	2 12 5†
Ever Ready (5/-) ..	35	35	28/6	—	6 2 10
Falk Stadelmann	15	15	43/-	−1/-	6 19 6
G.E.C. Ord. ..	22½	11½*	38/9	—	5 16 2
General Cables (5/-)	30	30	16/9	—	8 19 2
Greenwood & Batley	15	17½	49/9	—	8 11 9
Hackbridge Cable (5/-)	20	20	12/9	—	7 17 0
Hackbridge Hewittic (5/-)	20	20	18/-	—	5 11 1
Hall Tel. Acc. (10/-)	10	10	11/6	—	8 13 10
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (10/-) ..	20	10½*	17/6	—	6 0 0
Holophane (5/-) ..	20	20	12/6	—	8 0 0
Hoover (5/-) ..	35	25	26/3	—	4 15 0

Company	Dividend Previous	Dividend Last	Middle Price 9th Nov. 1953	Week's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)			£ s d		
Intl. Combustion (5/-)	25	15*	14/6	—	5 3 6
Johnson & Phillips	15	15	52/-	−1/-	5 15 6
Lancashire Dynamo	12½	12½	44/3	—	5 13 0
Laurence, Scott (5/-)	15	15	14/3	+1/6	5 5 3
London Elec. Wire	12½	15	75/9	+1/3	3 19 3
J. Lucas	7½	9½	47/6	—	3 17 3
Marryat & S. (2/-)	22½	22½	5/9	—	7 16 6
Mather & Platt ..	12½	15	53/-	—	5 13 3
Metal Industries ..	15	12*	40/9	−3d	5 17 8
Mid. Elec. Mfg. ..	15	15	61/3	+1/3	4 18 0
Murex	15	15	53/-	—	5 13 3
Newman Ind. (2/-)	10	10	2/3	—	8 17 9
Oldham & Son (1/-)	35	17½*	2/6	—	7 0 0
Parnall (Yate) (5/-)	6	6	3/9	—	8 0 0
Parsons, C. A. ..	10*	12½	96/3	+6/3	2 11 10
Plessey (5/-) ..	22½	25	32/6	+2/6	3 17 0
Pye Deferred (5/-)	18	20	21/-	+6d	4 15 3
Revo (10/-) ..	27½	27½	17/3	+3d	—
Reyrolle	10*	12½	77/6	+5/-	2 3 5
Scot. Cable (4/-) ..	32	20*	13/-	—	6 3 0
Siemens Ord. ..	10	10	35/-	+1/-	5 14 3
Southern Areas ..	5	6	18/-	—	6 13 4
Strand Elec. (5/-) ..	17½	17½	7/9	−6d	11 5 6
Sturtevant (5/-) ..	17¼†	18·1*†	29/-xr	—	3 2 1†
Sun Elec.	15	15	25/-	—	12 0 0
Switchgear & Cowans (5/-)	22½	22½	14/6	—	7 15 2
Taylor, T. (5/-) ..	20	25	21/3	—	5 17 9
T.C.C. (10/-) ..	20	20*	42/6	+1/3	—
T.C. & M. ..	10	8½*	29/-	+6d	5 15 3
Telephone Mfg. (5/-)	10	10	7/9	—	6 9 0
Thorn Elec. (5/-)	10	12½	13/-	+6d	4 16 2
Tube Investments	15*	15	64/6	−4/6	4 13 0
Vactric (5/-) ..	Nil	Nil	10/-	+6d	—
Veritys (5/-) ..	7½	10	4/6	—	11 2 2
Walsall Conduits (4/-)	70	70*	45/-	—	6 4 6
Ward & Goldstone (5/-)	45	45*	45/6	+6d	4 18 9
Watford (2/-) ..	25	25	5/4½	—	—
Westinghouse Brake	14	15	62/6	—	4 16 0
West, Allen (5/-) ..	15	15	13/6	+9d	5 11 0
Trusts, Transport and Communications					
Anglo-Am. Tel.: A Ord. ..	—	6	86½	—	6 18 9
Ord.	—	3½	57½	—	6 10 5
Anglo-Portuguese	8	8	22/9	—	7 0 8
Brit. Elec. Traction: Def. Ord. (5/-) ..	25	35	35/-	—	5 0 0
Cable & Wireless: Ord.	8	8	146	+2	5 9 7
4% Loan ..	4	4	97	—	4 2 6
Calcutta Trams ..	6†	2½†	18/9	+1/3	—
Cape Elec. Trams	5⅛	5⅛	10/-	+3d	11 0 0
Marconi Marine ..	10	10	28/9	—	6 19 2
Oriental Tel. Ord.	16	16	72/6	—	—
Telephone Props.	8	8	5⅝	+7/16	—
Tele. Rentals (5/-)	10	10*	10/-	+6d	5 0 0

* After capital bonus. † Dividends are paid free of income tax.

The above quotations are based upon the middle prices given in the Stock Exchange Daily Official List.

REPORTS and DIVIDENDS

Falk, Stadelmann & Co., Ltd., report a group profit for the year ended 31st March last of £400,156, as compared with £662,256 for the preceding year. After meeting all charges, including £185,246 for taxation, the net profit of the parent company is £56,795 (against £105,834), to which is added £81,486 brought in, and £17,696 provision written back, making £155,977 available. The pension and benevolent fund receives £10,000, and it is proposed to maintain the ordinary dividend for the year at 15 per cent with a final distribution of 5 per cent. The balance carried forward is £75,094.

In his circulated statement, Mr. H. Falk (chairman) says that a reduction in sales in certain departments took place in the first six months of the financial year which was slightly offset by increases in other sections. In the second half of the year, however, these reductions became intensified by reason of a general recession which affected nearly all sections. In particular, the cooker, domestic appliances and oil burning sections suffered mostly. Changes have taken place in the designs and types of these appliances, and the modernized range is already commanding satisfactory sales. Other factors affecting trading were the fall in the prices of many raw materials and increased competition, resulting in lower profit margins. Whilst they are still faced with many problems, there has been for some months in the home trade a more even flow of production and sales which show an encouraging increase as compared with the same period last year. Sales of subsidiaries also show a considerable increase. Exports are lower than last year, but with the easing of restrictions in some countries, these have begun to show an improvement. Production has started at the factory of their South African company. To obtain more effective co-ordination they have decided to consolidate some of the smaller factories with the larger works. A subsidiary cable works has been opened in Northern Ireland.

Tube Investments, Ltd., in a preliminary statement, shows a trading profit for the year to 31st July last of £5,872,259, as compared with £9,056,595 for the previous year, to which is added other income of £326,872, making £6,199,131. From this is deducted taxation of £3,415,171, and £63,788 outside interests, and after adding £1,033,958 tax adjustments, the available profit of the group is £3,754,130 (against £3,388,970). It is proposed to pay a final ordinary dividend of 7½ per cent, making 15 per cent for the year. For the previous year the final dividend was 8¼ per cent including ¾ per cent adjustment, and the interim was 13½ per cent on capital prior to the 100 per cent capital bonus.

The Perak River Hydro-Electric Power Co., Ltd.—The revenue from the sale of electricity, etc., for the year ended 31st July last amounted to £1,385,190, as compared with £1,266,709 for the preceding year. Generation costs, etc., totalled £596,437 (against £509,236), and after deducting London administration and general expenses, the balance is £796,617 (£764,616). Taxation requires £387,500, and the net profit is £159,117 (£132,777). General reserve receives £15,000 and contingency reserve £50,000. It is proposed to pay an ordinary dividend for the year of 5 per cent and a bonus of 1 per cent. The balance carried forward is £106,176 (against £103,403 brought in).

Burco, Ltd., reports a net profit, after charging £30,723 for taxation, of £62,560 for the year ended 30th September last, as compared with £54,281 for the previous year. It is proposed to pay a final dividend of 30 per cent (against 25 per cent), again making 35 per cent for the year. Application has been made to the Capital Issues Committee for permission to issue bonus shares by capitalization of reserves.

Heenan & Froude, Ltd.—The accounts for the year to 29th August last show group profits of £367,113, as compared with £394,003 for 1951-52. After crediting £1,350 provisions released, and deducting £213,788 for taxation, there is a net balance of £154,628 (against £144,515), to which is added £59,266 brought in. General reserve receives £100,000 and it is proposed to pay a final ordinary dividend of 10 per cent, making 15 per cent for the year. A similar distribution was made for the previous year and was supplemented by a special jubilee bonus of 2½ per cent.

Oliver Pell Control, Ltd.—A trading profit of £34,733 is shown in the accounts for the year ended 31st March last, as compared with £33,193 for 1951-52. The net profit, after meeting all charges, is £20,012 (£20,975). A preference dividend for 1½ years to 30th June, 1947, is paid and £20,493 is carried forward (against £2,918 brought in).

Taylor, Tunnicliff (Electrical Industries), Ltd., proposes to distribute 1,200,000 5s ordinary shares in the ratio of one for every ordinary share held. Treasury consent has been obtained to the capitalization of £300,000 of reserves. An extraordinary meeting to consider the proposal will be held on 10th December.

A. H. Hunt (Capacitors), Ltd., is offering to ordinary shareholders 100,000 4s ordinary shares at 10s each. Holders of every 2

ordinary held will be able to take up four of the new ordinary. The new shares will rank for any further dividend that may be declared in respect of the year ending 31st December next.

The English Electric Co., Ltd., proposes to capitalize £3,538,731 of reserves for the purpose of issuing ordinary shares to ordinary stockholders in the proportion of one new £1 ordinary share for every £2 of ordinary stock held. The new shares will be converted into stock and will rank *pari passu* in all respects with the existing ordinary stock. The company points out that the capitalization of reserves in no way increases its financial resources, and it should not be inferred that the total amount distributed as dividend on the larger capital will be higher than the amount if the capital had remained as at present.

Electrical Components, Ltd.—The directors are to issue 43,500 5½ per cent cumulative redeemable preference shares at 20s 6d. These shares will rank *pari passu* with the existing preference after the latter have gone ex dividend on or after 31st December next. The issue will take the form of an open offer to existing ordinary and preference holders.

Broadcast Relay Service, Ltd., has declared an interim dividend of 10 per cent, tax free, on £1,643,282 ordinary capital. This compares with an interim dividend last year of 8 per cent on £992,884 capital.

W. & T. Avery & Co., Ltd., have announced an interim dividend of 5 per cent (unchanged).

Ward & Goldstone, Ltd., have declared an interim dividend of 15 per cent (unchanged).

G. & J. Weir, Ltd., have announced an unchanged interim dividend of 5 per cent.

New Companies

G. F. Hardwick, Ltd.—Registered 22nd October. Capital £12,000. Manufacturers, suppliers and repairers of diesel engines of all kinds; electrical engineers, etc. Directors: G. F. Hardwick and Phyllis Hardwick. Regd. office: Waterdale, Doncaster.

Bridisco, Ltd.—Registered 15th October. Capital £1,000. To acquire the business of British Distributing Co., and to carry on the business of manufacturers of and dealers in electrical, mechanical, radio and scientific apparatus and equipment, etc. Directors: Winifred F. Aldington and B. P. Aldington. Regd. office: 591, Green Lanes, N.8.

Liquidation

Monarfon Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. S. O. Henry, 5, Rumford Place, Liverpool, 3, appointed 29th October.

Bankruptcies

R. L. Newell, trading as R. & R. Newell, High Bank Mill, Egremont, Cumberland, electrical engineer.—Last day for receiving proofs for dividend 21st November. Trustee, D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

G. Wilson, 28, Holmwood Drive, Leicester, formerly carrying on business at 1, Abney Street, Leicester, electrical engineer.—Trustee, Mr. E. C. Stimpson, 22, Regent Street, Park Row, Nottingham, released 29th October, 1953.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 28th November:—

SQUARE PATH. No. 721,285, Class 7. Electric alternators.—Brush Electrical Engineering Co., Ltd., Duke's Court, Duke Street, St. James's, London, S.W.1.

HILGER. No. 700,579, Class 9. Gauging, measuring, scientific and optical apparatus and instruments. HILGER. No. 700,580, Class 10. X-ray apparatus.—Hilger & Watts, Ltd., 48, Addington Square, London, S.E.5.

WINROD. No. 715,045, Class 9. Radio aerials.—Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

BARDUCT. No. B715,926, Class 9. Electric current transmission systems and parts thereof, all included in Class 9.—Marryat & Place, Ltd., 40, Hatton Garden, London, E.C.1.

TRIOGLAS. No. B717,119, Class 9. Electric batteries made with separators wholly or principally of glass. TRIOGLAS. No. B717,120, Class 17. Electric insulating material made wholly or principally of glass.—Accumulatorenfabriek "Varta" Naamloze Vennootschap, Amsterdam, Holland. Address for service, c/o Kilburn & Strode, 31–33, High Holborn, London, W.C.1.

ALADDIN. No. 718,719, Class 9. Electric kitchen utensils included in Class 9.—Aladdin Industries, Ltd., Aladdin Building, Western Avenue, Greenford, Middlesex.

FEC. No. 719,794, Class 9. Electrical apparatus and instruments included in Class 9; wireless apparatus; and parts included in Class 9 of all these goods.—London Electrical Manufacturing Co., Ltd., Beavor Lane, Hammersmith, London, W.6.

HANDETTE. No. B719,844, Class 9. Electric vacuum cleaners and electric floor polishing machines, all for domestic use.—Electrix, Ltd., Sterling Works, Dagenham, Essex.

WOODPECKER. No. 721,309, Class 9. Electrical apparatus included in Class 9 for controlling the operations of machinery.—Francis Shaw & Co., Ltd., Corbett Street, Ashton New Road, Manchester, 11.

BURNDEPT. (design) No. 721,233, Class 9. Radio and television receiving sets and parts included in Class 9, electric batteries, luminous signs, cases for electric pocket lamps; and electronic apparatus and electric kitchen utensils, all included in Class 9.—Burndept, Ltd., 681, Salisbury House, Finsbury Circus and London Wall, London, E.C.2.

No. 721,336 (design). Muffles, retorts, crucibles and tubes, all included in Class 9, all made of refractory materials and for use in metallurgical, glass, ceramic and like industries; semi-conductors and surge arrestors (electrical apparatus), and electric resistors and heating elements included in Class 9.—Carborundum Co., Ltd., Trafford Park, Manchester, 17.

NELO. No. 719,944. Class 11. Electric incandescent lamps.—Electromotives (Croydon), Ltd., Fountain Works, Fountain Road, Thornton Heath, Surrey.

PHYTOREL. No. 721,778, Class 11. Lighting installations and parts included in Class 11, all for use in the cultivation of plant life.—Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Address for service, c/o Feeny & Feeny, 2A, Charlwood Place, Westminster, London, S.W.1.

NEXT WEEK'S EVENTS

Monday, 16th November

BIRMINGHAM.—Birmingham Electric Club. "Radiology," by Dr. J. F. Brailsford.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "Telemetering for System Operation," by R. H. Dunn and C. H. Chambers.

LIVERPOOL.—Radiant House, Bold Street, 7.15 p.m. Incorporated Plant Engineers, Merseyside & North Wales Branch. "Fan Engineering," by R. H. Holbeche.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Illuminations and Decorative Lighting," opened by H. Carpenter.

Grosvenor House, W. 6.45 for 7.30 p.m. B.E.A.M.A. Annual dinner.

NEWCASTLE-UPON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurements Group. "A Method of Designing Transistor Trigger Circuits," by Prof. F. C. Williams and G. B. Chaplin.

Monday, 16th November, to Friday, 20th November

LONDON.—New Horticultural Hall, S.W.1. London Medical Exhibition.

Tuesday, 17th November

CAMBRIDGE.—University Arms Hotel, 7 p.m. I.E.E. East Midland Centre. "Electricity Applied to Mining," by C. D. Wilkinson.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 7.15 p.m. Incorporated Plant Engineers, South Wales Branch. "Mechanical Handling."

CHELMSFORD.—Public Library, 7 p.m. I.E.E. London Students' Section. District meeting. "Metallic Resistance at High Frequency," by A. D. Stevens.

DERBY.—Electricity Showrooms, 6.30 p.m. I.E.E. East Midland Centre. "Diesel Electric Locomotives," by G. E. Smith.

GLASGOW.—Grosvenor Restaurant. 6 for 6.30 p.m. I.E.E. Scottish Centre. Dinner-dance.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "The Technique and Development of Automatic Winding in Mine Shafts," by B. L. Metcalf and G. Cuttle.

LIVERPOOL.—Mersey & N. Wales E.B., Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Lamps and Lighting for Inspection," by H. E. Bellchambers.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. "Alternating-Current Instrument Testing Equipment," by Dr. A. H. M. Arnold.

Magnet House, Kingsway, 6.30 p.m. Association of Supervising Electrical Engineers. "Electrical Developments in Horticulture," by F. E. Rowland. (Joint meeting with Institution of Engineers-in-Charge.)

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilization Group. "The Wear of Carbon Brushes at High Altitudes," by R. F. Sims.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Design Features of Certain British Power Stations," by S. D. Whetman and A. E. Powell.

STAFFORD.—English Electric Co.'s Lecture Theatre, 7 p.m. I.E.E. North Staffs Students' Section. Senior Chairman's Address, "Some Applications of Electronics to Telecommunications," by Col. C. E. Calveley.

Wednesday, 18th November

COVENTRY.—G.E.C. Telephone Works, 7 p.m. I.E.E. South Midland Students' Section. "Electronic Musical Instruments," by P. Pugsley.

HALIFAX.—19/23, Northgate, 7.30 p.m. I.E.S. Huddersfield Group. "The Maintenance of Fluorescent Lighting Installations," by W. A. R. Stoyle.

INVERNESS.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. Chairman's Address, R. S. Goddard.

LONDON.—Savoy Hotel. Radio Industry Council. 7 for 7.30 p.m. Banquet.

I.E.E. London Students' Section. Visit to Royal Mint, Tower Hill, at 3 p.m.

At the Royal Society, John Adam Street, Adelphi, W.C.2, 2.30 p.m. Royal Society of Arts. Opening of 206th Session. Inaugural address, "The First President," by the Earl of Radnor.

MANCHESTER.—Café Royal. I.E.S. Manchester Centre. Annual dinner.

Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. National Lecture, "Recent Developments of Colour Television," by Dr. J. A. Darbyshire.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institution, Corporation Road. 6.30 p.m. I.E.S. Tees-Side Group. "Principles and Applications of Photo-electric Cells," by S. Rodda.

NOTTINGHAM.—E.M.E.B., Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. "Master and Slave Clock Systems," by E. O. Chapman.

OXFORD.—37, George Street, 7 p.m. I.E.E. district meeting. "Control of the National Grid," by P. J. Squire.

PRESTON.—19, Friargate, 7.15 p.m. I.E.S. North Lancashire Group. "Glass and the Lighting Industry," by P. M. Davidson.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "An Assessment of the Impregnated Pressure Cable," by Dr. L. G. Brazier, D. T. Hollingsworth and Dr. A. L. Williams.

WIMBLEDON.—Guild House, 32, Worple Road, 8.15 p.m. A.S.E.E. South West London Branch. Branch lecturettes.

Wednesday, 18th November, to Saturday, 28th November

MANCHESTER.—City Hall, Deansgate. Fuel Efficiency Exhibition.

Wednesday, 18th November, to Wednesday, 2nd December

LONDON.—Olympia. Building Exhibition.

Thursday, 19th November

BLACKBURN.—Grosvenor Hotel, Lord Street, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "Electrical Hazards," by D. A. Picken.

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "The Co-ordination of Insulation of High-Voltage Electrical Installations," by J. S. Cliff.

KETTERING.—George Hotel, 7.30 p.m. I.E.E. East Midland Centre. "Electricity in Farm Crop-Drying," by C. A. Cameron Brown and P. G. Finn-Kelcey.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilization Section. "The Wear of Carbon Brushes at High Altitudes," by R. F. Sims.

I.E.E. London Students' Section. Visit to Waterloo Station signal box, 6.45 p.m.

MALVERN.—Winter Gardens Restaurant, 7.15 p.m. I.E.E. South Midland Centre. District meeting. "Printed and Potted Electronic Circuits," by G. W. A. Dummer and D. L. Johnston.

SHEFFIELD.—Grand Hotel. Incorporated Plant Engineers, Sheffield & District Branch. Annual dinner.

TONBRIDGE.—Bridge Café, 32, High Street, 8 p.m. A.S.E.E. Kent Branch. "Electrical Installations in Large Buildings," by W. F. Parker.

(*Continued at foot of page* 1141)

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 23rd December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

9164. Postmaster General.—Piezo-electric apparatus. 11th September, 1950. (701432.)

32522. Patelhold Patentverwertungs- & Elektro-Holding Akt.-Ges.—Magnetrons. 19th December, 1949. (701254.)

32729. Philips Electrical, Ltd.—Electric-discharge tubes. 21st December, 1949. (701255.)

1950

8711. Board of Trustees of Leland Stanford Junior University.—Electron-discharge tube apparatus for the production of high-frequency electrical energy. 6th April, 1950. (701256.)

18437. Parmiter, Hope & Sugden, Ltd.—Electric fuses. 24th July, 1951. (701377.)

20117. Ericsson Telephones, Ltd., and Acton, J. R.—Electrical-discharge tubes. 9th August, 1951. (701378.)

26696. General Electric Co., Ltd., and McKeag, A. H.—Luminescent materials. 31st January, 1952. (701266.)

27237. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Device for ascertaining the phase of an alternating voltage. 7th November, 1950. (701447.)

30544. Philips Electrical Industries, Ltd.—Devices comprising a cathode-ray tube for reproducing images. 14th December, 1950. (701270.)

1951

22. Cook & Williams Proprietary, Ltd., F. L.—Electric plug-and-socket connectors. 1st January, 1951. (701292.)

34. Cowburn, H. G., and Allday, H. C. R.—Wall or other boxes for fuses, switches, or other electric circuit connecting means. 25th February, 1952. (701388.)

869. General Electric Co., Ltd., Simpson, A. I. F., and Warren, P. F.—Electric oscillation generators. 4th February, 1952. (701389.)

9113. Swf-Spezialfabrik für Autozubehör G. Rau Ges.—Electrically driven windscreen wiper. 18th April, 1951. (701454.)

9592. Dunlop Rubber Co., Ltd.—Fault detection by ultrasonic waves. 4th April, 1952. (701455.)

9977. Philips Electrical Industries, Ltd.—Transmission systems containing terminal stations and relay stations. 27th April, 1951. (701328.)

9979. Philips Electrical Industries, Ltd.—Electric-discharge tubes for velocity-modulation systems. 27th April, 1951. (701302.)

9994. Electric & Musical Industries, Ltd.—Magnetizable iron oxides. 18th March, 1952. (701224.)

10004. British Klockner Switchgear, Ltd.—Apparatus or devices for starting and protecting electric motors. 18th April, 1952. (701303.)

10231. General Electric Co., Ltd., and Ribchester, E.—Television receivers. 23rd April, 1952. (701457.)

10717. Grisley, F.—Electrically heated pads or blankets. 24th January, 1952. (701304.)

14244. Standard Telephones & Cables, Ltd.—Electric-discharge devices. 15th June, 1951. (701307.)

14583. American Felt Co.—Storage batteries and separators therefor. 20th June, 1951. (701331.)

15745. Philips Electrical Industries, Ltd.—Electric-discharge tubes. 3rd July, 1951. (701308.)

16966. Soc. Industrielle de Liaisons Electriques.—Electric cables exposed to the action of flames. 17th July, 1951. (701309.)

17064. General Electric Co., Ltd., and Bryer, R. F.—Hydraulic control devices. 18th July, 1952. (701310.)

19452. Nederlandse Centrale Organisatie voor Toegepast-Natuur-Wetenschappelijk Onderzoek.—Electrodialysis apparatus with anode, dialyzate and cathode compartments, separated from each other by flexible membranes. 17th August, 1951. (701466.)

19570. Modrey, H. J.—Electrical plug-and-socket connecting devices. 20th August, 1951. (701408.)

20407. Cinema-Television, Ltd.—Radio-frequency transformers. 28th August, 1952. (701334.)

20852. Hoover, Ltd.—Electric polishers. 4th September, 1951. (701409.)

23049. Fortiphone, Ltd.—Testing apparatus for short circuited turns. 25th September, 1952. (701412.)

24193. Crabtree & Co., Ltd., J. A., and Carding, J. T.—Electric fuses. 9th October, 1952. (701415.)

24952. Philips Electrical Industries, Ltd.—Method of electrolytically pointing wires and electrode system comprising a pointed electrode. 25th October, 1951. (701474.)

25097. Standard Telephones & Cables, Ltd.—Circuit arrangement producing saw-tooth current waves for deflection purposes. 26th October, 1951. (701416.)

26000. Oldham & Son, Ltd., and Morton, H.—Miners' cap lamps. 3rd October, 1952. (701283.)

26637. British Insulated Callender's Cables, Ltd.—Arrangements for the electric control of fluid-pressure valves. 13th November, 1952. (701243.)

26867. Ohio Crankshaft Co.—Heating of metal strip by high-frequency induction. 16th November, 1951. (701338.)

NEXT WEEK'S EVENTS (*continued*)

Friday, 20th November

EXETER.—Imperial Hotel, 7 p.m. Exeter Electric Club. Annual dinner-dance.

LEEDS.—Queen's Hotel, 7 for 7.30 p.m. I.E.E. North Midland Centre. Annual dinner.

LONDON.—Waldorf Hotel, W.C.2. Institution of Works Managers. Annual general meeting.

Feathers Hotel, Broadway, S.W.1, 6 p.m. Electrical Trades' Commercial Travellers' Association. Annual general meeting.

MANCHESTER.—Grand Hotel. Incorporated Plant Engineers, Manchester Branch. Annual dinner.

NEWCASTLE-UPON-TYNE.—King's College, 6.30 p.m. I.E.E. North Eastern Students' Section, Tyneside meeting. "Astronomy," by T. W. James. (Joint meeting with students of the North East Coast Institution of Engineers & Shipbuilders, I.Mech.E., and I.C.E.)

Royal Turk's Head Hotel. North East Electrical Club. Annual dinner.

NOTTINGHAM.—Black Boy Hotel. Incorporated Plant Engineers, East Midlands Branch. Ladies' evening.

STONE.—Crown Hotel, 8.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dance.

Saturday, 21st November

LONDON.—I.E.E. London Students' Section. Visit to Radiology Department, St. Bartholomew's Hospital, 10.30 a.m.

27083. Forges et Ateliers de Constructions Electriques de Jeumont, and Teszner, S.—Lightning arrestors. 19th November, 1951. (701285.)

29258. Busch-Jaeger Lüdenscheider Metallwerke Akt.-Ges.—Electric rotary switches. 13th December, 1951. (701340.)

1952

245. Philips Electrical Industries, Ltd.—Luminescent materials. 3rd January, 1952. (701420.)

329. Westinghouse Electric International Co.—Series capacitor installations for a.c. lines. 4th January, 1952. (701344.)

745. Meacher, W.—Electric-pressure detectors. 26th August, 1952. (701479.)

1816. General Motors Corporation.—Rotors for dynamo-electric machines. 23rd January, 1952. (701346.)

3174. Bendix Aviation Corporation.—Electrical plug-and-socket connectors. 6th February, 1952. (701350.)

3614. Marconi's Wireless Telegraph Co., Ltd.—Television and like transmitter installations. 17th October, 1952. (701482.)

9269. Chase-Shawmut Co.—High interrupting capacity electric fuse. 10th April, 1952. (701428.)

14714. Philips Electrical Industries, Ltd.—Supports for image amplifiers. 11th June, 1952. (701487.)

15611. Standard Telephones & Cables, Ltd.—Method of balancing telephone cables, means of carrying out same and cables balanced by said method. 20th June, 1952. (701359.)

17144. Marbourn, Ltd.—Dolly-operated electric switches. 10th September, 1952. (701361.)

17703. Compagnie Générale d'Electricité.—Apparatus for measuring cross-talk in transitory state. 14th July, 1952. (701492.)

20711. General Electric Co.—Insulated seals for electric devices. 18th August, 1952. (701496.)

22965. Schlumberger Well Surveying Corporation.—Apparatus for electrical logging of wells. 12th September, 1952. (701498.)

27432. General Electric Co.—Electrically heated surface cooking units. 31st October, 1952. (701367.)

29277. Lignes Télégraphiques et Téléphoniques.—Manufacture of tubular conductors for telecommunication cables. 19th November, 1952. (701369.)

MECHANICAL HANDLING IN A MALTING

THE latest methods of mechanical handling are used in a new malting built for Sandars & Co., Ltd., at Grimsby. With most of the machinery automatic in operation, labour costs have been drastically reduced as compared with those of other floor maltings in use to-day. In addition, the barley is untouched by hand from the time the sacks are brought in from the combine harvesters until it is despatched as malt.

On the malting floors, electric push-button operated transporters carry the two tank cars and three automatic floor turning machines from bay to bay and floor to floor. The machines spread the steeped barley and carry out numerous thickening up and thinning out operations in the twenty-four malting bays with only four men in attendance. The floor machines are all electrically driven and controlled by a 110 V d.c. circuit from a 35 kW motor-generator and they are fed from overhead bare copper conductors, supported from the concrete ceilings. Facilities are provided for locating the cross traversers at the proper position opposite a working floor bay and to allow the machine to pass over from the traverser on to the working floors by its own power. Reversing and speed control are also included. An electric lift accommodates any machine for transference to another floor. The electricity consumption of all machines running together costs approximately 8d to 10d per hour.

During the malting process there are several screening and automatic weighing operations and the malt is moved from one stage to another by various types of conveyor and elevator, screw, bucket, band and chain. Apart from a little brushing up, the discharge of the four kilns is automatic, and can be carried out by one man in one hour. The fan (3 h.p.) in each turret is capable of extracting 9,400 cu ft/min of air. The malting floors are air conditioned.

Robert Boby, Ltd., were the main machinery contractors, air conditioning being carried out by J. & E. Hall, Ltd., and all electrical work, other than the actual floor turning machinery, by the Alliance Electrical Co., Ltd.

Floor turner in action at Sandars & Co.'s malting, Grimsby

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Alnwick.—25th November. U.D.C. Erection of 55 electric street lights and conversion of 52 existing gas lamps to electricity. Plans from the town surveyor, Council House.

Australia.—BRISBANE.—8th January. City Council. 2,000 kWh meters. (E.S.B. 8145/53. Ten/7475.)*

Barking. — 20th November. Corporation. Street lighting equipment. (See this issue.)

Belfast.—30th November. City Surveyor's Department. Electrical installation in connection with alterations and improvements to Ormeau Avenue Public Baths. Architectural Section (Room 85), City Hall.

4th December. Electricity Department. Circulating water screening plant. (See this issue.)

Brighouse.—10th December. Street lighting equipment. (See this issue.)

Chelmsford.—24th November. Corporation. Provision of street lamps. (See this issue.)

Deben.—4th December. R.D.C. Submersible type centrifugal pump and electric motor, with equipment, at Tuddenham. Forms from Pick, Everard, Keay & Gimson, engineers, 6, Millstone Lane, Leicester.

Dover.—30th November. Corporation. Street lighting equipment. (See this issue.)

Down.—19th November. County Education Committee. Electrical installation at Holywood intermediate school. Munce & Kennedy, architects, 133, University Street, Belfast.

Egypt. — CAIRO. — 28th November. Cairo Electricity and Gas Administration. Switching and transformer substations for Cairo International Airport and territory. (See this issue.)

Gosforth.—27th November. U.D.C. Street lighting equipment. (See this issue.)

India. — BOMBAY. — 7th January. Bombay Electric Supply and Transport Undertaking. 22 kV and 6·6 kV switchgear and accessories. (C.R.E. 18201/53. Ten/6485B.)*

London. — 27th November. India Store Department. Wireless kits. (See this issue.)

Longbenton.—5th December. U.D.C. Electrical installations in 22 houses at Kelvin Park estate. (See this issue.)

Matlock.—7th December. U.D.C. Pumping plant for extensions to the Lea sewage disposal works. Forms from W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham.

Newport (Salop).—7th December. U.D.C. Street lighting equipment. (See this issue.)

New Zealand.—WELLINGTON.—2nd February. State Hydro-Electric Department. 33 kV oil circuit breakers and accessories. (E.S.B. 6747/53. Ten/7477.)* 16th February. Two 220 kV 3-phase airbreak switches. (E.S.B. 8273/53. Ten/7489.)*

26th January. Post and Telegraph Department. Electric cables. (E.S.B. 8154/53. Ten/7474.)*

Pakistan.—KARACHI.—1st December. Posts and Telegraphs Directorate. Loading coil cases and building out network cases. (E.S.B. 7868/53. Ten/7461.)*

CHITTAGONG.—30th November. Department of Supply and Development. Tumbler switches. (E.S.B. 8263/53. Ten/7493.)* X-ray plant. (E.S.B. 8265/53. Ten/7498.)*

Romford.—4th December. Corporation. Electrical installations in 60 flats and 74 houses. (See this issue.)

St. Helens.—30th November. Corporation. Street lighting equipment. (See this issue.)

Sedgley.—8th December. U.D.C. Street lighting equipment. (See this issue.)

South Africa. — JOHANNESBURG. — 6th January. City Council. Switchgear for two substations. (E.S.B. 8107/53. Ten/7466.)*

United States. — DENVER (COLORADO). — 24th November. Department of the Interior, Bureau of Reclamation. Instrument transformers and disconnecting fuses for Anchorage substation, Eklutna Project, Alaska. (E.S.B. 7595/53. Ten/7465.)*

Uruguay. — MONTEVIDEO. — 4th December. Administracion General de las Usinas Electricas y los Telefonos del Estado. H.v. line insulators. (E.S.B. 7850/53. Ten/7479.)*

ORDERS PLACED

Enfield.—Urban District Council. Electrical installations in 300 dwellings, Hoe Lane North site, Bullsmoor Lane Central and "H" contracts (£11,500).—A. Tindall & Sons.

Longbenton (Northumberland).—U.D.C. Concrete columns and sodium discharge lighting units from Benton Road to Clousden Hill, Forest Hall.—Revo Electric Co., Ltd.

Newcastle-on-Tyne. — Corporation. Electrical installation at the proposed new primary school at Stockfield Avenue (£5,017).—Electra (Birmingham), Ltd.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barrow-in-Furness. — Extensions to the central library; borough surveyor.

Bedford.—Nursery; county architect, Bedford.

Belfast.—Operating theatre suite, Whiteabbey Hospital; Gibson & Taylor, architects, 16, Donegall Square South.

Billingham-on-Tees.—Houses (109) on the Roseberry Road estate for the U.D.C.; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Birmingham.—Adaptations at Wyddrington, Church Road, Edgbaston (£39,478), communal laundry as extension of slipper baths in course of erection at Windon Green (£43,000) and two-storey flats in Victoria Road, Aston; H. J. Manzoni, city engineer.

Chesterfield.—Congregational Church hall and Sunday school, Soresby Street; A. P. Taylor, architect, Belper.

Shops, Calow (Allpits Farm) estate; R.D.C. engineer, Chesterfield.

Colne Valley.—Houses (30), Corn Mill Field, Slaithwaite, for U.D.C.; Holroyd, Brook & Eaglands, Ltd., Old Bank Works, Slaithwaite.

Corby.—Shopping centre, Welland Vale Road; G. B. Blackall, clerk to U.D.C., Council Offices, Corby, Northants.

Dagenham.—Mechanical engineering workshop; Samuel Williams & Sons, Ltd., Dagenham Dock.

Darlington.—School, Firth Moor; borough architect, Central Buildings.

Derby.—Two new operating theatres at Royal Infirmary; Sheffield Regional Hospital Board, Fulwood House, Sheffield.

Doncaster.—Technical high school for boys; architect to Education Committee.

Ealing.—Flats (64), Broughton Road; Dunham & Wire, architects, 44, Great Russell Street, W.C.1.

Henley-on-Thames. — Dwellings (74); E. G. V. Hives, architect, 3, Cork Street, Reading.

Kingston-on-Thames. — Synagogue in Uxbridge Road; United Synagogues, Upper Woburn Place, London, W.C.1.

Liverpool.—Factory at Edge Lane for Dellagana & Denby, Ltd.; A. E. Shennan, architect, 17, North John Street.

London.—CITY.—Office block, St. Swithin's Lane; London Assurance, Ltd., 1, King William Street, E.C.4.

HOLLOWAY.—Refectory at Holloway Polytechnic; Thomas E. Scott, architect, 2, Verulam Buildings, Gray's Inn, W.C.1.

KENSINGTON. — Police station, Earls Court Road; Metropolitan Police Architect's Department, New Scotland Yard, S.W.1.

Melksham (Wilts).—Houses (20), Breakway site; engineer and surveyor, Town Hall.

Mere and Tisbury.—Houses (13), East Knoyle; Bothams & Brown, architects, 3, Chipper Lane, Salisbury.

Middlesbrough.—Additions to fire brigade headquarters (£10,000); borough engineer.

Crematorium, Acklam (£25,000); J. A. Kenyon, borough engineer.

Kitchen/dining rooms at Archibald Primary and Secondary Modern Schools; education architect.

Newcastle-on-Tyne. — Conversion of "Hermiston" into home for old people (£10,000); city architect, 18, Cloth Market.

Northants.—Rothwell-Desborough Secondary Modern School (£110,000) and new classroom block at Brackley High School; county architect, Northampton.

Nottingham.—Four schools in the Bilborough and Clifton areas; R. M. Finch, city engineer.

Oldbury.—Dwellings (183), Titford estate; borough surveyor.

Perivale.—Factory extension; Pond's Extract, Ltd., Wandsworth Road.

Rawtenstall.—School clinic and child welfare centre; county architect, Preston.

Redruth.—Extensions to Barnclose Hospital; South Western Regional Hospital Board, 27, Tyndalls Park Road, Bristol.

Rotherham. — Houses (90), Kimberworth Park estate; borough engineer.

Runcorn.—Houses (47), Lumb Brook; R.D.C. surveyor.

St. Albans.—Houses and flats (54), Langley Grove estate, Sandridge; architect to R.D.C., 43, Upper Lattimore Road.

Salford. — Police headquarters (£250,000); John Dickinson & Co. (Bolton), Ltd., Fairclough Street, Bolton (recommended).

Public washhouse at Camp Street, Broughton; city engineer.

Stockport. — Branch library, Brinnington estate; W. Chapman Dobson & Partners, architects, Jordangate, Macclesfield.

Sutton Coldfield.—Housing estate, Thornhill Road; John McLean & Sons, Ltd., Coven, Standford.

Tonbridge.—Flint making factory, Vale Road (£40,000), for British Flint & Cerium Manufacturers, Ltd.; A. C. Durrant, secretary, Tonbridge.

Vange (Essex).—Houses (333) for Basildon Development Corporation; H. W. Dupree, chief engineer, Gifford House, London Road, Bowes Gifford, Essex.

Wakefield. — Semi-detached houses (118), Eastmoor estate; Harlow & Milner, builders, Warrengate, Wakefield.

Wellingborough.—Shops (12), maisonnettes, flats, etc., on the Croyland Hall Farm estate; Blackwell, Storry & Scott, architects to U.D.C., Gold Street Chambers, Kettering.